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The National Encyclopedia

THEMISTOCLES

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THEMISTOCLES (c.514 - c.449 B.C.), Athenian statesman and admiral. Regarding the Persian invasion of Greece in 490 B.C. as the precursor to another more formidable one, he urged the Athenians to build a great navy. As chief archon in 481 B.C., he persuaded them to devote the silver mined at Laurium to this purpose. In the following year when the Persians did invade Greece again, and breaking through the pass of THERMOPYLAE, approached Attica, he persuaded the Athenians to abandon Athens and take refuge in Salamis, pinning all their hopes on their fleet. In this connection he is reported by the historian Herodotus to have received an oracle from Delphi to the effect that Athens should trust to her wooden walls. As commander of the Athenian fleet, Themistocles precipitated an engagement with the Persians before the Spartan Eurybiades, the supreme admiral of the entire Greek fleet, could withdraw his vessels to the south of the isthmus of Corinth. In the narrow passage to the bay of Salamis, where the Persians could not make effective use of their numerical superiority, Themistocles gained a brilliant and decisive victory. After the Persian menace was removed by the Greek victory at Plataea, 479 B.C., Themistocles, foreseeing that Athens' future was on the sea and in the development of her commerce, built the long walls connecting Athens with the Peiraeus, her port, and strongly fortified the latter, despite a vigorous protest from Sparta whose jealous fears were easily aroused. In 471 B.C. on a charge of misuse of public funds Themistocles was ostracized. A few years later, named by the Spartans as the accomplice of their own admiral Pausanias, who was discovered in a treasonable correspondence with Persia, Themistocles fled from Argos, where he had resided since his banishment from Athens. He took refuge, strangely enough, at the Persian court, and a few years later he died a revered citizen of Magnesia. Themistocles by the development of the Athenian navy, by his insistence upon the defence of central Greece, and by his brilliant strategy at Salamis saved Athens, and through Athens, Greece. He also pointed clearly the path of Athens' future development.

THEOBROMINE. See DIURETICS.

THEOCRACY (Greek, *theos*, God, and *Kratos*, power), a form of civil government in which God is recognized as ruler and his commandments are regarded as the laws of the community. The term

was coined by Josephus to describe the Jewish state.

During the period of the Jewish monarchy, the king was understood to rule by the will of God and was thus an organ of theocracy. Still more important organs were the prophets, whose great authority kept alive the Jewish nationality in Babylon. Returning from exile, Israel set out to be a perfect theocracy with the priesthood as the principal organ of government. The priesthood, however, became worldly as their wealth increased, and the more spiritual among the Jews looked forward to the coming of a Messiah who should establish a veritable kingdom of God.

To some extent theocratic ideas underlie Brahminism, Islam, Roman Catholicism and such monarchies as claim to be based on divine right. Even democracy assumes a theocratic aspect when the voice of the people is regarded as the voice of God. In modern times the most striking examples have been given by the Calvinists at Geneva, the Puritans in New England and the Jesuits in Paraguay.

THEOCRITUS (3rd century B.C.), Greek poet, celebrated as the first pastoral poet, was probably a native of Syracuse, though this birthplace is disputed. He is believed to have lived for some time at the court of Ptolemy Philadelphus at Alexandria, later returning to Sicily in the reign of Hiero II (270-216 B.C.) Theocritus was the originator of Greek pastoral poetry. (See PASTORAL.) Thirty-one poems and a number of epigrams have come down to us under his name, though the authenticity of some of these is doubted. The poems, bearing the general title of *Idylls*, are usually classified as bucolics, mimes, epics and lyrics. Some of the *Idylls* are not entirely free from the artificiality of the Alexandrine Age, yet they possess an admirably life-like and dramatic quality; they are written chiefly in the Doric dialect and in dactylic hexameter. In all of them Theocritus reveals a deep understanding of rural life and a true love of nature. See also GREEK LITERATURE.

THEODOLITE, a surveying instrument primarily for measuring horizontal angles, but employed also for measuring distances and vertical angles. It has a TELESCOPE which can be accurately pointed at an object by means of cross-hairs, or lines, in the focal plane of the eyepiece. A cross axis attached to the telescope at right angles rests in trunnions at the upper ends of two standards which are attached to a circular plate that turns in a horizontal plane on a vertical

spindle, or center. This center revolves within another center, attached to the lower circular plate which carries a graduated circle. On the upper plate are two or more verniers for reading the fractional parts of the smallest divisions on the circle. In instruments intended for the most precise work the verniers are replaced by micrometer microscopes capable of reading angles to fractions of a second. When the theodolite is provided with a vertical circle, a vernier, and a level, it may be used for taking vertical angles. If there are also two horizontal spider lines in the reticle, distances may be read by noting the space on a rod intercepted between these threads. *See* TACHEOMETRY.

The name theodolite is used generally in Europe. In engineering practice in the U.S., TRANSITS are used almost exclusively, the theodolite being confined mainly to geodetic SURVEYING. G. L. H.

THEODORA (c. 508-548), wife of the Emperor JUSTINIAN. According to the *Secret History* of Procopius she was a notorious courtesan, daughter of a bear-keeper at the Hippodrome. After certain unsavory adventures she seems to have been converted by the MONOPHYSITES in Egypt. She then returned to Constantinople, where she captivated Justinian, becoming his mistress and later his wife. Henceforth she led a most exemplary life. Elevated to the throne with her husband in 527, she became a power in the government. Her courage and determination saved the throne during the Nika riots of 532. A lover of pomp and glory, she was largely responsible for the Oriental magnificence of Justinian's court. Ambitious, unscrupulous and cruel, she proved a powerful friend and a dangerous enemy. Her favorite, Vigilius, was elevated to the papal throne. Another favorite, Narses, replaced her enemy BELISARIUS as general in Italy. Part of her independent income she devoted to charitable foundations, notably an institution for fallen women. In opposition to Justinian's policy she protected and encouraged the Monophysites, in the conscious effort to lessen religious dissension. A true Oriental, she saw that imperial destiny lay in unifying the East, rather than in the futile reconquest of the West. Theodora died in 548.

THEODORE, name of two popes. Theodore I, 642-649, opponent of Monothelitism, excommunicated the Patriarch Phyrus of Constantinople. Theodore II was Pope from November to December, 897.

THEODORE, HON. EDWARD GRANVILLE (1884-), Australian statesman, was born at Fort Adelaide, South Australia, Dec. 29, 1884. He was educated in Australia, and from 1909 has been active in public life. He was a leader of the Labor Party from 1919 to 1925. In London, in 1924, he negotiated an important Australian loan.

THEODORIC THE GREAT (c. 455-526), King of the Ostrogoths, was born in Pannonia about 455, the son of King Theodemir. He succeeded to the throne about 475. He extended his rule by defeating Odoacer, who had usurped power in what is now Italy. Theodoric has been called "the Great" because of the wisdom, justice and general religious

tolerance of his reign. He greatly improved public works and established prosperity throughout his domains. It is believed by some that his death in 526 was caused by remorse for permitting the execution of the Catholics, SYMMACHUS and BOETHIUS.

THEODOSIUS I, THE GREAT, known as Flavius (c.346-395), Roman Emperor, was born about 346 in Spain. He accompanied his father, a famous Roman general, in various campaigns, and in 378 was summoned by Gratian to share the empire. In 379 Theodosius was made Augustus over the Eastern provinces. His wars against the Goths were successful, and by diplomacy his enemies were induced to become his allies. He marched against Maximus, the conqueror of Gratian, and defeated the usurper in 388. After Valentinian II, son of Gratian, had been assassinated by Eugenius and Arbogast at Rome, Theodosius met the murderers in battle, and defeated them, aided, it is said, by St. Philip and St. John. He then set up his son Honorius as emperor at Rome, with Stilicho as his adviser. In his religious policy Theodosius further strengthened Christianity and proscribed paganism; his reign marks the triumph of the former as the religion of the state. The position to which the Church had attained is clearly illustrated by the penance laid upon him by Bishop Ambrose before permitting him to enter the Cathedral at Milan, after the massacre of some of his subjects at Thessalonika. Theodosius died in Milan, Jan. 17, 395.

THEOLOGY. When trained thinkers try to expound clearly, systematically and persuasively what is involved in a recognized form of religion, e.g. Judaism, Islam, Christianity, their effort and its formulated results go by the name of theology. Theological doctrines authoritatively approved by competent officials of a religious communion, and made binding on all its members, are called dogmas.

Factors in the Growth of Theology. These may be classified as follows: i. Religious experiences, writings, institutions and practices of individuals and of groups, centering typically around human needs, from need of food to need of mental and moral betterment, and their satisfaction through the working of powers beyond those of the individual. Advanced religion tends to concern itself most with the profound human need for personal renewal and enlargement, regeneration and salvation. But archaic and advanced religion appear side by side in the same group, and often in the same individual. ii. Changing thought and practice respecting the nature of the world and of man: science and philosophy, accepted theological doctrines, folklore and other uncriticized beliefs, and practices associated with each. iii. Changing thought and practice respecting values and the control of conduct: ethical theory, political and legal practice, customs and folkways. iv. Economic needs and industrial advances. v. Commerce, and mass movements of peoples: cultural contacts, conquest and assimilation. vi. The steady yet varying influence of the whole environing universe, in which most people affirm the presence and activity of one or more super-

human Beings affecting human life and thought. Theology, in short, though having problems and methods of its own, is interwoven with the whole fabric of human culture.

Growth of Christian Theology. An illustration of the interplay of these factors is afforded by the growth of Christian theology. With a warning that summaries must not be taken too solemnly, we may say that Christian theology has passed through two main phases: i. *Synthesis and construction*. From the ministry of Jesus to the late 13th century the major drift, in spite of strong cross-currents, was integrative. Till nearly 500, while Greek metaphysics still occupied the educated Mediterranean world, theology developed mainly in acute and profound discussions of the nature of God, the world and man, and Jesus Christ as center; into which came tributary streams of early Christian, Jewish, Greek, Oriental, and Western thought. The Latin genius for pithy statement and firm control helped fix their results in dogmatic creeds and disciplinary laws, regarded as derived from the Scriptures, and decreed by the Holy Spirit active in the Church. During the next five centuries, while metaphysical interest continued in the East, preoccupation with discipline dominated the Latin West, where the Empire had collapsed and a period of disorderly mass movements set in. It was now that the Latin Church took on imperial character, seeking to impose the Roman ideal of order on the turbulent new peoples. Theology advanced little; the ancient dogmas became ever more sacrosanct and unalterable. But in the development of church organization, ritual and discipline, within the crude feudal culture now taking shape, was a mass of new material for theology. A swift and brilliant climax of theological synthesis came during the 11th to 13th centuries. Disciplinary and revived metaphysical interests coalesced. Ancient dogmas and tradition, accumulations of folkways and folk-beliefs, newer ecclesiastical practices and claims, a disconcerting wealth of scientific and philosophic theories from Arab and Jewish sources and the Greek East, all were combined in the towering structure of Christian Scholasticism, built with the tools of logic, but founded on the authority of the Scriptures, creeds, tradition, and above all the Church. *See also* CHRISTIANITY.

ii. *Critical analysis and revision*. But the very factors which brought this era of triumphant advance: swift growth of schools and opportunities for study, religious and intellectual pioneering, intercultural contacts, accumulation of new data, etc., quickly made even the expanses of Thomist thought too narrow. New factors also: rising nationalism and social radicalism in revolt against imperial control; rising bourgeois power undermining the whole feudal system; secular scholarship rediscovering forgotten beauties of classical paganism and critically testing the documents used by theologians; science and discovery opening up new views of the world. A first revision by 16th century leaders swept away, for Protestants, much detail concerning saints and sacraments and the quasi-feudal

hierarchy, and took a long step toward affirming, with new insight and outlook, the sole dependence of every man upon God; but the main Protestant bodies reaffirmed the authority of the Scriptures and kept the early dogmas intact. Since the 16th century, rapid development of the natural sciences, physics, geology and biology; and then of the social sciences, history, anthropology and psychology, has brought more searching analysis of the traditional theology, except in the Roman Catholic and Eastern Orthodox churches, which officially maintain their ancient views; and among certain conservative Protestant groups. New understanding of the physical universe and of animal life; historical study of the Bible, of Christianity, and of other religions; psychological and sociological study of human thought and behavior have thrown floods of light upon theological problems. Like the first wave of revision, this later wave has involved loss of some old values, clarifying and reorienting of others, and a gain of new insights that now seem indispensable. The movement continues unabated, along with efforts to retain older formulations unchanged, and efforts to effect new syntheses. From the present turmoil, new syntheses may or may not soon emerge. There awaits them a much broader base than the older ones had, for they can command both the labor of earlier theologians and our wider knowledge of man, the world and religion. But they must develop under the testing fires of the sciences and of increasingly complex human needs; and they will require free criticism and revision for healthy growth.

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THEOPHRASTUS (c. 372-287 B.C.), Greek philosopher, was born at Eresus, Lesbos, about 372 B.C. He studied philosophy at Athens under Plato and Aristotle, of whom the latter chose him as successor to the headship of the Peripatetic school. Theophrastus preserved, in an independent spirit, the traditions of his great master, and was held in high esteem during the 35 years that he presided over the school. His writings were voluminous. He is chiefly celebrated for his works on botany and is regarded as the founder of that science. Two of the botanical works are partially preserved, *On the History of Plants*, originally in ten books, nine of which remain, and *On the Causes of Plants*, of which six of the original eight books are extant. There is also preserved in fragmentary condition a treatise on *Stones*, a work on *Metaphysics* and other writings. His work entitled *Characters* has enjoyed wide popularity. The descriptions of various types of characters reflect the author's analytical mind and comprehensive knowledge of life, and portray the life of his times.

THEOSOPHY, a term used in the general sense of soul-lore, but used specifically to refer to the doctrines promulgated by Mme. Blavatsky, who along

with Col. Olcott founded the Theosophical Society in New York in 1875. This cult is patterned after that of the Mahatmas of India and Thibet and aims to produce higher stages of spiritual existence by contemplation and discipline. Mme. Blavatsky established a shrine in Adyar, India, from which the messages from the Mahatma emanated and in which miracles were performed, by aid of the "Akasic force." In this enterprise she was detected by Hodgson of the Society for Psychical Research in fraudulent collusion.

Her following continued and at her death in 1891 she was succeeded by Annie Besant, and the center moved to California. The cult continues in a combination of occult mysticism with an oriental flavor and a modification of New Thought.

THERAPEUTAE ("Worshippers of God"), a community of ancient Jewish ascetics who dwelt near Alexandria, Egypt, at the time of PHILO JUDAEUS (c. 20 B.C. to 40 A.D.). The sole record of their former existence is preserved in Philo's *De Vita Contemplativa*, or *On the Contemplative Life*. There is no evidence to indicate that the Therapeutae were even partially a Christian sect or group.

Each member of the Therapeutae lived in a separate cell where he spent the whole day in mystic devotion, ascetic practices and especially in the study of the Torah, or Law. When in such solitary retirement they ate no meat and drank nothing, but recited the Psalms and the various hymns which they themselves had composed. In this respect they differed from the ESSENES, of which brotherhood they would appear to have been an offshoot; for the Essenes always lived in the form of a permanent community or brotherhood, and practiced all their rites in common. Another respect wherein they were different from the Essenes was that, unlike the latter, they admitted women to their community; such women ate at separate tables in the assembly hall, far from the men, and during the expounding of the Law the women sat in a section of the assembly hall which was shut off by a partition from the men's section. Little is stated by Philo about the functions of these women members except that they used to nurse and teach the stray Jewish and non-Jewish children who found their way to the community.

The Therapeutae adhered exclusively to the allegorical interpretation of Scriptures. They offered thanksgiving in the morning, at sunrise, for the light both of the day and of the Torah, and at sunset they uttered another prayer for the removal of the sunlight. All their meals were eaten after sundown. Some of the Therapeutae were so stringent that they ate only on the Sabbath, fasting on the six days from Sabbath to the next Sabbath; others ate one meal during the course of the week.

The Sabbath Day among the Therapeutae was a day of the common study of the Law and of a holy communion meal partaken of by all together in a large hall. The meal was preceded by an exposition of the Law by each in turn; it consisted merely of bread, salt and herbs, and only water was drunk.

After this common meal certain passages of the Scripture were expounded, and hymns were sung by all the members of the community. Aside from the Sabbath, the Therapeutae were especially zealous in celebrating the eve of the festival of Shabuoth (Pentecost, the Feast of Weeks), which they called "the night of the Seventh Sabbath." Such nocturnal celebrations were especially sacred to them. On this night they ate unleavened bread, and sang songs of thanksgiving and uttered praise to God throughout the entire night.

A. SH.

THERAPEUTICS, the science of applying remedies in the prevention and treatment of disease. It is the function of the therapist to remove, if possible, the cause; or, if he is unable to do so, the effect of a disease process. If it is impossible to do either, then his duty is to permit life to maintain itself as comfortably as may be under abnormal circumstances.

The physician's ideal aim is at specific therapy, or treatment that has a special curative relation to the disease, as the use of quinine in malaria, or of certain arsenicals and mercury in syphilis, or of thyroid in hypothyroidism. Unfortunately, we have few specifics.

When specific therapy is not available, the physician is by no means helpless. If he cannot remove or antagonize the cause of the disease specifically, he can at times alter the body (alterative therapy) so as to make it unsuitable for continued existence of the disease. In tuberculosis, for instance, in which we have as yet no way of killing the tubercle bacillus (the seed), cure is often compelled by making the body (the soil) unsuitable for its growth, because of exuberant vitality, by means of rest and graded exercise, good food, fresh air, and sunshine.

When the doctor can do nothing against a disease along the lines indicated, he can practice symptom therapy, i.e., securing the relief of distressing symptoms to the extent of making the patient as comfortable as his best interests permit.

Assuaging pain is, next to prolonging life, the doctor's most important business. Nevertheless, the physician worthy of the name will not remove pain without at the same time doing all that can be done to remove its cause. The doctor must not always remove symptoms, much as the patient may wish him to do so. Thus, most coughs are useful in aiding in the expulsion of offending material; and so are many diarrheas. There are some kinds of cough and diarrhea, however, that the physician may check with full benefit to the patient.

An interesting illustration of the blindness of Nature's curative efforts and of rich opportunity for therapeutic action, is found in the so-called vicious circles; conditions in which an effect, beneficial in itself, produces other effects, that in turn aggravate the original condition. Thus, when the heart is unable, by reason of weakness, to overcome the strain imposed upon it, dilation occurs. It must dilate or else it would burst. But, having dilated, it must now expel more blood with each beat. It also beats more rapidly. It must, in other words, do more work

when, because of its weakness, it should do less work. This lack of rest still further weakens it, and makes it still less able to bear the ordinary strains of life. The physician breaks in on this vicious circle by putting the patient to bed, in this and other ways, procuring the rest the heart needs to return to a more nearly normal condition.

Even in hopeless and malignant cases, such as inoperable cancer, the physician is able to help by applying his art of pain annihilation, thus providing comfort up to the inevitable end. In incurable non-malignant conditions, such as hardening of the arteries, Bright's disease, valvular heart disease, the physician can do a great deal more by so adjusting the demands life makes upon the crippled organ as to permit the handicapped individual to enjoy a comfortable and efficient existence for a much longer period than Nature unaided would have granted. By periodic "health examinations" such conditions may be discovered in their incipency and, by wise management, kept from reaching a handicapping degree for a long time.

One of the most important functions of the physician is to recognize and take care of a patient's own disease-picture complex; i.e., what the patient himself thinks about his ailment and how he feels toward it; for, to the patient, this complex represents the real disease. Curiously enough, this complex is more often wrong than right; for the degree of physical suffering is no indication of the seriousness of the condition; and fear may exaggerate, while hope may minimize the appreciation of the real seriousness of the case. It is often quite as necessary for the physician to remedy an erroneous disease-picture complex, as it is to take care of the bodily deviation from the normal.

Various compound words are employed to indicate different subdivisions of therapy: e.g., dietotherapy, hydrotherapy, electrotherapy, mechanotherapy, psychotherapy. Efficient therapeutics requires the use and recognition of any and all of these forms of treatment. There are physical, chemical and psychic causes of disease, and it may take physical, chemical or psychic remedies to cure. It is a truism that many ailments are due to wrong mode of living. Discovery of what is wrong and teaching the proper mode of living is as decidedly the physicians' work as is the prescribing of drugs or of other remedies.

B. F.

THEREZINA, the capital city of the state of Piauh, Brazil, situated inland on the River Parnahyba about 220 mi. distant from the port city of that name. It is well-built, with low plastered houses, wide streets and numerous plazas. Therezina has several manufacturing works, sugar refineries and cotton mills. Pop. 1920, 57,500; est. pop. 1930, 64,379.

THERESA or **TERESA OF JESUS** (1515-82) Catholic saint and mystic, was born at Avila, Old Castile, in Spain, Mar. 28, 1515. She was educated by Augustinian nuns at Avila. Here an accidental acquaintance with the letters of St. Jerome impelled her to adopt the religious life, and she entered the Carmelite convent at Avila. Her health became seri-

ously impaired, however, and to ease her suffering she fell into those habits of mental prayer that led to mystical experiences of an unusual nature. She submitted to the guidance of her Dominican and Jesuit spiritual confessors and gradually gained peace of mind. Her spiritual biography ranks with such works as the *Confessions of St. Augustine* and is contained in the writings entitled: *Life*, written by herself; *The Relations*; and the *Interior Castle*. These are authentic personal documents of mystic experience and show considerable intellectual and analytical powers.

Theresa founded the convent of Discalced Carmelite Nuns of the Primitive Rule of St. Joseph of Avila (1562), and also many other convents ruled by the prescribed austerities of the primitive rule of Carmel. She was beatified in 1614 and canonized in 1622 by Gregory XV. Her feast was fixed on Oct. 15. She died at Alba de Tormes, Spain, Oct. 4, 1582.

THERMIONIC VACUUM TUBE. See TUBES, ELECTRONIC.

THERMIT WELDING, a process by which a molten mixture of metals, largely high-carbon iron oxide and aluminum, is poured around a broken casting or forging. This heats the broken portions sufficiently to effect a weld or fusion with the mixture poured into the mold. Thermit was extensively used in repairing broken locomotive and steamship parts before the advent of gas and electric welding. Where the part must be machined afterward the high carbon content of the thermit mixture is an objection and other methods of WELDING are largely used. F. H. C.

THERMOCOUPLES measure temperature by the thermal electromotive force which exists at the junction of two dissimilar metals. For a current to flow, the circuit must be closed and hence there must be a second junction. If these junctions are at the same temperature, the electromotive forces will be equal and opposite and no current will flow. But if one junction is at a higher temperature than the other, a current will flow, the strength of which will depend, among other things, upon this difference in temperature. A sensitive galvanometer which measures this current may be calibrated to read temperatures directly. The current depends upon the total resistance of the circuit, while the electromotive force depends only upon the temperature difference. It is better, therefore, to establish a relation between the temperature of the hot junction and the electromotive force, measured by a millivoltmeter or a potentiometer, when the cold junction is kept constant—preferably at 0°C.

At least one of the metals is usually an alloy. In spite of its high cost, the platinum-platinum-rhodium thermocouple is the standard for work between 300°C. and 1500°C. When used with a precision POTENTIOMETER, it will detect differences of less than 1°C. at 1000°C. The so-called "base metal" couples are quite satisfactory for many purposes and, on account of their lower cost, they are much used in industrial processes. Thermocouples are particularly adapted to use with recorders. They are sometimes used to measure accurately small differences in temperature. They

can also be used to provide thermostatic control at high temperatures.

As the hot junction of a thermocouple must be protected against contamination to maintain the constancy, much research has been done to develop robust protecting tubes impervious to furnace gases. W.W.S.

THERMODYNAMICS deals fundamentally with the inter-relations between heat and mechanical actions but it has been extended gradually to include the relations between heat and any other form of energy. To the engineer, the subject implies the study of steam and gas engines, refrigerating machines, and similar subjects. To the physicist and the physical chemist, the implications cover a much wider field.

Thermodynamics is based upon two fundamental principles which, by universal custom, are called the First and Second Laws of Thermodynamics. The First Law is sometimes stated: "Whenever any transformation of mechanical energy into heat or vice versa occurs, there is an exact proportionality between the energy of the kind that disappears and the energy of the kind that is produced at its expense." Another statement, due to Planck, is: "It is in no way possible, either by mechanical, thermal, chemical, or other devices, to obtain perpetual motion."

The Second Law was stated by Clausius, one of the pioneers in this field, somewhat as follows: "It is impossible for a self-acting machine, unaided by any external agency, to convey heat from a body at a low to one at a higher temperature; or heat cannot of itself (that is, without the performance of work by some external agency) pass from a cold to a warmer body." One of the statements given in the English edition of PLANCK's *Thermodynamics* is: "It is impossible to construct an engine which will work in a complete cycle, and produce no effect except the raising of a weight and the cooling of a heat-reservoir." In whatever form they are stated, it should be understood that these laws are statements that are based upon universal experience and are not subject to formal proof.

The First Law of Thermodynamics is really a statement that heat is a form of energy, and therefore obeys the fundamental principle of the *conservation of energy*. The famous experiments of JOULE on the MECHANICAL EQUIVALENT OF HEAT had much to do with the recognition of this.

The theoretical investigations of CARNOT (see CARNOT's REVERSIBLE CYCLE), which antedated Joule's work, are bound up with the interpretation of the Second Law. He showed that all reversible engines, working between two temperatures, T_1 and T_2 , have the same efficiency, irrespective of what material is used as the "working substance." Also he showed that no engine working between these two temperatures can possibly have an efficiency greater than that of a reversible engine. For if one engine had an efficiency greater than the other, the first could be caused to operate the other in the reverse direction and thus heat would be transferred from the lower temperature to the higher without aid from an external agency. That is, perpetual motion of the sec-

ond class would be possible. Although Carnot assumed the truth of the caloric theory of heat, his conclusions are still valid.

When a *perfect gas* is used as the working substance, i.e., a gas which obeys BOYLE'S LAW, CHARLES' LAW, and JOULE'S LAWS perfectly, the energy changes in the various steps of a Carnot's cycle can be evaluated mathematically, and it can be shown that the efficiency of a reversible engine working between the *absolute* temperatures T_1 and T_2 (where T_1 is greater than T_2) is $\frac{T_1 - T_2}{T_1}$.

This result is of prime importance in discussing many theoretical problems and in the discussion of steam and other heat engines since it gives the limiting efficiency of a perfect engine. For example, assume that a steam engine takes steam at a pressure of 135 lb. per sq. in. and that the steam is exhausted at 2 lb. per sq. in. These pressures correspond to 350.3°F. and 126.1°F. respectively. Reduced to absolute Fahrenheit we have $T_1 = 809.9^\circ$ and $T_2 = 585.7^\circ$. Therefore the greatest possible efficiency of this steam engine is $\frac{809.9 - 585.7}{809.9}$ or 27.7%. Since

the practical limit for the temperature of the exhaust is determined by the surroundings, increased efficiency must be obtained by going to higher temperatures and pressures for the intake. Although it is possible to transform any other form of energy *completely* into heat, it is *never* actually possible to transform a given quantity of heat completely into any other form of energy. This would require the use of a "refrigerator" at absolute zero ($T_2 = 0$) in order that the efficiency, $T_1 - T_2$, be 100%. In actual processes in nature, other forms of energy are always eventually transformed into heat. Thus, when a stone falls to the ground, the potential energy that it possessed at first is transformed into the kinetic energy of its motion, and when the stone strikes the ground, this energy is transformed into heat. No energy is *lost*, but it is impossible to make the heat so generated lift the stone back to its original height. That is, some of the energy has been rendered unavailable. In other words, the ENTROPY of the system is increased.

The two laws of thermodynamics find many important applications in theoretical chemistry, especially in the form of the PHASE RULE. Both theoretical and practical thermodynamics frequently require the use of involved mathematical analysis, in which entropy, thermodynamic potentials, and various other complicated functions are used. W.W.S.

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THERMOGALVANOMETER. The thermogalvanometer, designed by Duddell about 1904, can be used with either direct or alternating currents. It is essentially a Boys' radiomicrometer equipped with a suitable heater. A single loop of copper wire, ending in an antimony-bismuth thermojunction, is suspended by a delicate fiber between the poles of a powerful magnet. A heating coil surrounds this thermojunc-

tion without interfering with the motion of the loop about the vertical axis. When a current, either direct or alternating, passes through this heating coil, a current due to the thermojunction flows through the copper loop and produces a deflection.

THERMOMETER, CLINICAL, a special form of maximum thermometer with a limited range of 95° to 110° F., or 35° to 45° C., for measuring the temperature of the human body. Just above the bulb the tube is constricted. When the bulb is heated, e.g., by being held in the patient's mouth, the mercury is forced past this constriction. While the thermometer is being read the bulb may cool, but the mercury separates at the constriction and the reading remains unaltered. Before the thermometer is used again, some mercury must be shaken down into the bulb. To assist in taking readings, the stem is curved so as to magnify the thread of mercury in it.

THERMOMETRY includes any methods used to measure temperature or differences in temperature. We have sense organs which detect differences in temperature by "feeling," but we cannot *measure* temperature in terms of sensation. Pieces of metal usually feel hotter or colder than pieces of wood at the same temperature because metals are better conductors of heat than wood.

Fundamental Interval. We measure distances in terms of some standard distance, such as the foot or the meter. So in measuring temperature we need some standard temperature difference to serve as a "yard-stick." This is called the fundamental interval. It is defined by two temperatures, called the fixed points, which can be reproduced without relying directly upon any thermometer. One of these, the temperature of melting ice, is commonly called the *ice-point* or *freezing point*. The other, called the *steam* or *boiling point*, is the temperature of the saturated steam above pure water boiling at the standard pressure of 760 mm. of mercury.

Temperature Scales. To be useful, this fundamental interval must be subdivided into degrees, as a yard-stick is divided into inches. On the **CENTIGRADE TEMPERATURE SCALE** there are 100 divisions between the ice-point and the steam-point; on the **FAHRENHEIT TEMPERATURE SCALE** 180 divisions; and on the **RÉAUMUR TEMPERATURE SCALE** 80 divisions.

Kinds of Thermometers. Any property of a substance, which changes in a known manner with the temperature, can be used for measuring temperature. Among those most frequently used are: change in volume of liquids, e.g., the ordinary thermometer; change in pressure of a gas at constant volume, e.g., the gas thermometer; change in length of solids as in the bimetallic thermometer; change in electrical resistance as in the **RESISTANCE THERMOMETER**; change in thermo-electromotive force as in **THERMOCOUPLE PYROMETERS**; change in total heat radiated as in **RADIATION PYROMETERS**; change in intensity of light emitted as in **OPTICAL PYROMETERS**.

The Mercury-in-Glass Thermometer consists of a glass capillary tube of uniform bore, sealed at the

upper end and terminating at the lower in a bulb, usually cylindrical in shape. The bulb and part of the stem contain mercury. Any change in temperature produces a change in the volumes of both the glass and the mercury, but the rate of expansion for mercury is greater than for glass. Consequently the mercury rises in the stem as the temperature increases. In calibrating the instrument, the heights at which the mercury stands at the *fixed points* are marked upon the stem. Then the *volume* between these two marks is divided into the proper number of equal parts—100 if it is to be a centigrade instrument. This process involves certain very important assumptions, viz., it is assumed that equal changes in temperature produce equal changes in the volume of the mercury, relative to the glass, at all temperatures throughout the range. Experiment has shown that this is *not* the case. Further, different varieties of glass behave very differently under similar conditions, so that two thermometers which look alike and which agree in their readings at the *fixed points*, may give readings which differ appreciably for some intermediate temperature. The question naturally arises as to which thermometer gives the "correct" temperature. It would be possible to choose some particular thermometer, which had been made with great care, as the standard, but such a temperature scale would be arbitrary and therefore not entirely satisfactory. Lord Kelvin's **ABSOLUTE TEMPERATURE SCALE** avoids this difficulty. The corrections necessary to reduce the indications of a properly calibrated mercury-in-glass thermometer to the requirements of the absolute scale are usually negligible.

The extreme range of the ordinary mercury thermometer is from the freezing point of mercury, -40° C., to its boiling point, 360° C., but its indications near these extremes are not reliable. By filling the stem above the mercury with an inert gas, e.g., nitrogen, the range can be extended to the softening temperature of the glass, about 600° C., as the pressure due to the gas raises the boiling point of the mercury. Below -40° C. alcohol or toluene are often used. Because of its larger coefficient of expansion, colored alcohol is frequently used instead of mercury for household thermometers. Mercury is superior to other liquids because it does not wet the glass and is less volatile.

Metal Expansion or Bimetallic Thermometers usually depend upon the unequal rates of expansion of two metals made up into a compound bar. For example, a strip of iron may be fastened throughout its length to a strip of brass. The coefficient of expansion of brass is nearly double that of iron. The unequal changes in length caused by change in temperature will cause the bar to bend. Or if it be rolled into a flat spiral, it will coil tighter or uncoil with change in temperature. One end of the spiral is fastened securely and the motion of the other is magnified by levers and communicated to a pointer which moves over a dial. These instruments are frequently used as thermographs.

Condition for Any Temperature Measurement. It is very important to note that any thermometer in-

icates only its own temperature. When used to measure the temperature of another object, the thermometer is brought into as intimate contact with the object as possible, and it is then assumed that the thermometer and the object are at the same temperature.

W. W. S.

THERMOPILE. The thermopile, as originally used by Melloni in studying radiation, consists of many bismuth-antimony thermojunctions (*see* THERMOCOUPLE PYROMETERS) joined in series. These are arranged in a small cube with alternate junctions in opposite faces. One face, which is blackened, is turned toward the source of radiation while the other is shielded from it. The temperature difference thus established between alternate junctions sets up an electromotive force which, when measured by a suitable GALVANOMETER, indicates the intensity of the radiation. The thermopile is not as sensitive as the BOLOMETER or the radiomicrometer.

W. W. S.

THERMOPOLIS, a town in north central Wyoming, the county seat of Hot Springs Co. It is situated on the Big Horn River, 110 mi. northwest of Casper and is served by the Chicago, Burlington and Quincy Railroad. Thermopolis is noted for its medicinal hot springs. Sulphur and coal mines, gas and oil fields are in the vicinity and sheep raising is an important industry. Pop. 1920, 2,095; 1930, 2,129.

THERMOPYLAE, a pass in Greece leading from Locris north into Thessaly, famous as the scene of three important battles and known for the hot springs from which it has derived its name. The most notable battle occurred in 480 B.C. when the Persians under Xerxes were invading Greece, and the Spartan Leonidas, with 300 men, was set to defend the pass, then about 50 feet wide. Through the treachery of Ephialtes, a Thessalian, the Persians were shown a path over the mountains which permitted them to fall on the rear of the Greek forces and divide the army, leaving Leonidas and 300 men in the pass, all of whom fought until they were killed. In 279 B.C. the Gauls under the leadership of Brennus were held at the pass by a large army of Greeks, and they too were victorious after discovering the mountain pass. Later in 191 B.C. Antiochus of Syria held this point against the invading Roman army led by M. Acilius Glabrio; but Cato was able to rout the Syrians after storming the fortress and making a center attack. The old pass no longer exists; it has widened to three miles in some places and is now visited for the hot springs the waters of which have medicinal value.

THERMOS BOTTLE or **THERMOS FLASK.**
See VACUUM FLASK.

THERMOSTAT, a device for maintaining the temperature of its surroundings at some predetermined value. The principle of modern thermostats is that some form of thermometer is arranged to open or close an electric circuit automatically when the temperature deviates from the desired value. This circuit operates a relay which controls the heating. The details of the various thermostats differ widely. The

instrument that maintains a room at 68°F. usually consists of a strip of hard rubber riveted to a strip of metal. This compound bar is clamped at the upper end. The lower end carries suitable electrical contact-points. The action is exactly like that of a bimetallic thermometer (*see* THERMOMETRY). If the temperature rises, one of the contact-points completes a circuit which shuts off the heat. As the temperature falls, the bar bends in the opposite direction, thus breaking this circuit and eventually closing another circuit which turns on the heat. Where a more sensitive control is required, a large bulb of toluene is sometimes used, so arranged that the expansion or contraction of the toluene moves a column of mercury back and forth. The electric circuit is controlled by contacts which are opened or closed by the mercury.

W. W. S.

THESAURUS, a word-book akin to a DICTIONARY, designed to present in some convenient form a treasury of synonyms, antonyms, idioms and phrases. Its contents may be arranged alphabetically or in a classified order, each system having its advantages. The *Thesaurus Dictionary of the English Language*, by Francis A. March and F. A. March, Jr., 1902, an outstanding thesaurus, is arranged alphabetically. Mawson's *Standard Thesaurus*, Roget's *Thesaurus* and Hartrampf's *Vocabularies*, 1929, all excellent works, are arranged in classified order. Mawson's *Standard Thesaurus*, for example, is divided into six classes of words, those expressing abstract relations, space, matter, intellectual faculties, voluntary powers, and sentient and moral powers. Three older thesauri of note are Crabb's *English Synonyms*, 1816, Smith's *Synonyms Discriminated*, 1882, and Soule's *Dictionary of English Synonyms*, 1871.

THESEUS, Athenian national hero. Theseus, a figure largely, if not entirely, legendary, was regarded by the Athenians as one of their early kings, and has been accredited by Thucydides with the union of Attica, which until his time was said to have been divided into a number of more or less independent communities. The most famous legend about him is that by slaying the Minotaur in Crete with the help of Ariadne he released Athens from the painful necessity of sending an annual tribute of seven maidens and seven young men to King Minos of Crete as offerings to the MINOTAUR. This legend may actually reflect a time when Athens did pay tribute to Crete, and it may be that under a king named Theseus the Athenians shook off the Cretan yoke. The other legends about Theseus have apparently no historical foundation whatsoever. He was reputed to have sailed with the Argonauts to win the GOLDEN FLEECE, to have attempted the abduction of Persephone from the underworld, to have conquered the Amazons and married their queen Antippe, and to have performed many other exploits.

THESPIS (c. 540?B.C.), the father of Greek tragedy, was a native of Icarus, in Attica, long the chief seat of the worship of Dionysus and also the birthplace of the Old Attic Comedy introduced there

by SUSARION. Thespis was an actor as well as a poet, and led the chorus. The performance consisted of a prologue, chanting by a choir and intervening recitations by the leader of the chorus who was the only actor. The latter wore different masks which were also an innovation of Thespis. His plays were crude and were soon replaced by the work of better authors, an actor being introduced to make dialogue possible. **ÆSCHYLUS** brought two characters into his plays and **SOPHOCLES** three, meanwhile reducing the chorus to a minor part. There is a belief that Thespis was a strolling player such as existed at a much later date in Europe and America.

THESSALONIANS, EPISTLES TO THE, in the New Testament, are two letters usually believed to have been written by the Apostle Paul to the church at Thessalonica, a populous city of Macedonia, now known as Salonika. It is thought that the first letter is the earliest of Paul's epistles and was written from Corinth, probably in 53 A.D., and the second, a year later. The main theme of the first letter is the second coming of Christ, when "we that are alive" shall be "caught up in the clouds to meet the Lord in the air," a belief of the Apostles which was also held by many early Christians, who hoped not to die. The second letter was written to correct misunderstandings in the first; but it has been questioned as a work of Paul, because of its repetition of matter in the first letter.

THESSALONIKI. See SALONIKA.

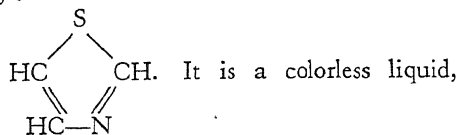
THESSALY, the largest section of ancient Greece, lying south of Macedonia and between Epirus and the Aegean Sea. It is a region of rich plains, bordered in part by high mountains. Located here is the celebrated Vale of Tempe, a beautiful valley through which flows the Peneus River. In the 4th century B.C. Thessaly was conquered by Philip of Macedon. Several centuries later it came under the rule of the Romans.

THETFORD MINES, a mining and industrial city of Megantic Co., Quebec, Canada, situated on the Quebec Central Railway, about 70 mi. south of the city of Quebec. About 85% of the world's supply of asbestos is mined in the environs, together with considerable quantities of talc and chromic iron. Thetford Mines contains numerous industries, including asbestos plants, foundries, sash and door, and cement block factories. Pop. 1921, 8,272; 1931, 10,701.

THETIS, in Greek mythology, a Nereid, daughter of **NEREUS** and **Doris** and wife of **PELEUS**, King of the Myrmidons. Her son was **ACHILLES**. She was so beautiful that many gods loved her, but were afraid to woo her because of the prophecy that she would bear a son greater than his father. At her request **ZEUS** aided the Greeks in the Trojan War. She dwelt in the sea with her father, giving help to **HEPHAESTUS** when he was cast from heaven and to **Dionysus** (see **BACCHUS**) when he fled from **Lycurgus**.

THIAZOLES, organic compounds belonging to the heterocyclic division, which may be considered as derived from a parent substance, itself called thia-

zole, which is composed of one sulphur, one nitrogen, and three carbon atoms cyclically united into a five-membered ring, with a hydrogen atom attached to each of the carbon atoms, hence its formula is $C_3NS \cdot H_3$, or



somewhat resembling pyridine, and forms the basis of a numerous class of synthetic dyes. Important among these is primulin, comprising three benzene rings, fused to two thiazole rings, which gives yellow, brown and reddish shades on unmordanted cotton, but which is not fast to light.

THIEF RIVER FALLS, a town in northwestern Minnesota, the county seat of Pennington Co. It is situated at the junction of Thief and Red Lake rivers, 90 mi. northeast of Fargo and is served by two railroads. The town is a market and shipping center for wheat and dairy products, and has flour mills. Pop. 1920, 4,685; 1930, 4,268.

THIERS, LOUIS ADOLPHE (1797-1877), French statesman and historian, first president of the Third Republic, was born at Marseilles, Apr. 16, 1797. Educated for the law he went to Paris in 1821, entered journalism and soon became an enthusiastic supporter of liberalism against the reactionary influences which led to the revolution against Charles X in 1830. With Talleyrand and others he brought about the choice of Louis Philippe as king and served repeatedly as prime minister during the first ten years of the July Monarchy, the last time being for a short period in 1840. After that he joined the opposition against Guizot and, as a progressive, contributed much to the movement that led in the revolution of 1848. He was a member of the constitutional convention of 1848 and of the legislature from 1848 to December 1851, when he was arrested and exiled by Louis Napoleon. After his return he was elected to the *Corps Législatif* in 1863 and became again the leader of the opposition, staunchly protesting against the declaration of war in 1870. With the collapse of the empire his ability and experience at once brought him into prominence, first as the diplomatic agent of the republic to foreign capitals and then as chief of the executive power chosen by the newly elected National Assembly in February 1871. In this capacity he negotiated the peace with the Germans, suppressed the Commune, paid the war indemnity and freed the territory of foreign occupation. Confronted by the plans of the monarchical majority in the Assembly to overthrow the republic and restore the monarchy, Thiers, up to then an Orleanist, announced his support of the republic. This brought down on his head the bitter denunciations of the monarchists and he was forced to resign on May 24, 1873. Besides the liberation of the territory he had rebuilt the local government of France and brought about a thorough reorganization of the army.

Along with his political activities, Thiers was a distinguished journalist, founder and editor of the *National* and a historian of rare insight and power. In 1823 he published the first of ten volumes on the *History of the French Revolution*, completed in 1827, and between 1845 and 1862 the *History of the Consulate and the Empire*. Like Napoleon I of small stature, and like him, a man of enormous energy, he was aptly called by his admirers "the greatest little man of French history." He died at St. Germain-en-Laye, Sept. 3, 1877. W. E. L.

THIESS, FRANK (1890-), German writer, was born at Eluisenstein, Mar. 14, 1890. His first novel, *Der Tod von Falern*, 1921, was followed by *Die Verdammten* in which he wrestles with the problem of love between brother and sister. Later works include *Angelika ten Swaart*, *Der Leibhaftige*, 1924, *Der Tod zu Welt*, 1926, and *Abschied vom Paradies*, 1927. Thiess is noted for his psychological probings into the great modern questions.

THIO-COMPOUNDS. The term "thio" is derived from Greek, meaning sulphur. From the close relationship of sulphur to oxygen in the PERIODIC TABLE, it may be expected to form analogous derivatives. Many inorganic compounds are named as thio-compounds, as thio-sulphate, thio-carbonate, thio-cyanate, etc., but the term is more generally applied to organic compounds. The substitution of sulphur for oxygen in organic compounds is quite universal, giving thio-alcohols, -ethers, -acids, -dyes, etc. The compounds with bivalent sulphur resemble those of bivalent oxygen but while oxygen seldom exercises any other valence, sulphur is frequently tetravalent and more often hexavalent. The formation of sulphur derivatives closely parallels the corresponding oxygen compounds. There is a marked difference in the physical and chemical properties of the oxygen and sulphur compounds, the difference being more pronounced in some classes than others. As a rule the sulphur compounds are more susceptible to oxidation and reduction. Among the thio-compounds are found the disagreeable odors of MERCAPTANS and oil of garlic, the deadly MUSTARD GAS, the source of innumerable synthetic dyes (see DYES, SYNTHETIC), rubber accelerators, and the basis for many pharmaceuticals. Petroleum from many fields contains thio-compounds, which must be removed since they are injurious to motors. J. E. C.

THIRD DEGREE, a term applied to informal investigations of suspects and witnesses immediately after being taken into custody. Its purposes are to obtain confessions for use at trials, to gather information and to induce pleas of "guilty" after confession.

It is usually administered by policemen and detectives, although prosecuting attorneys sometimes take part. The means employed vary greatly. Physical force is generally denied, but it is frequently used. "Mental pressure" is admitted and its use upheld by many police officials.

It violates the legal principles that a man shall

not be compelled to give evidence against himself and that confessions obtained under duress are not admissible as evidence. It is dangerous because these confessions may be false and it may defeat itself, as juries have acquitted and Appellate Courts have reversed cases on the ground that confessions have been obtained under duress. G. W.

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THIRD ESTATE (*Tiers État*). In medieval times the word estate meant a social class. The privileged feudal classes of clergy and barons formed the first two estates. Some local French assemblies as early as the 12th century added townsmen to the other two orders, and in the Estates General from the beginning in 1302 these burghers formed a third estate. The expression "third estate" is not used until the late 15th century. In 1789 the Third Estate, imbued with vague ideas of popular sovereignty and claiming to represent the French people, by insisting on the organization of the National Constituent Assembly, started the French Revolution.

THIRD INTERNATIONAL, THE, or the Communist International, *Commintern*, as it is sometimes called, is a revolutionary organization founded in Mar. 1919, by Lenin and his associates, notably Zinoviev. The First International was organized in 1864 under the official name of the International Workingman's Association with the definite purpose to promote the rights of labor throughout the world. After a decade it went out of existence and in 1889 the Second International was founded in response to the growing influence of Socialism in the countries of western Europe. Most of the Socialist and Labor parties were affiliated with it, and its meetings furnished an international forum for the discussion of socialist policies and programs. As a result of the intense nationalism of the World War which swept the Socialists into its current the Second International disappeared in its turn. Finding it impossible to revive it and make of it a means of transforming the socialist and labor parties of different countries into Communist organizations, the Bolsheviks decided to create a new one of their own, the Third International.

It was assured liberal subsidies from the Soviet Treasury and was to serve as a "Central office or headquarters for the proletariat army of the world." Its acknowledged objective was a world revolution against the capitalist system, by carrying on Communist propaganda in other countries, by getting control and direction of the socialist and labor parties in different countries, by uniting and strengthening the Communist elements in various countries, and by abetting and aiding events leading "towards world revolution."

While the Soviet government disclaims all official connection with the Third International it is clear that the leaders and membership of both are much the same and that both are agencies of the powerful

and highly disciplined Russian Communist Party. The activities of the Third International quickly appeared in different countries; in the communist disturbances in Germany in 1919, in the short-lived régime of Bela Kun in Hungary, in the radicalism of the socialists in Italy and in their attempts to run the industries, and in widespread and well financed propaganda in England, the United States and Asia, where its ideas at first found a favorable reception among the masses of China, India and to some extent Japan.

THIRD PARTIES. In English-speaking countries, where the two-party system generally prevails, minor or third parties often appear for the purpose of promoting some particular interest or as a consequence of schism in one of the major parties. In British politics, for example, the Irish Nationalists contended for Home Rule; the Liberal-Unionists, seceding from the Liberal party, opposed it. During the past generation Labor has advanced at the expense of Liberalism and taken its place as a major party. In the United States third parties have been numerous since the Civil War, and several of them (Prohibition, Socialist) have persisted over a considerable period. But only three times before the Civil War and three times after it have they polled as much as 10% of the popular vote or received any electoral votes whatever. Only on three occasions have they affected the result of a presidential election. They discharge a useful function in bringing forward policies which the major parties ignore and in measuring the volume of popular dissent and protest.

E. M. S.

BIBLIOGRAPHY.—E. M. Sait, *American Parties and Elections*, 1927.

THIRD SECTION. Part of the reorganization of the Imperial Chancery undertaken by Nicholas I upon his accession to the Russian throne in 1825 consisted in the establishment of a special section, the so-called Third, composing the State Police. This section employed a spy network penetrating all branches of national life and administration. Schools, officialdom, and clergy were placed under police surveillance. Imperial policy, projects for new legislation, and the administrative conduct of the highest officials were closely scrutinized by this organization, which also introduced the methods of provocation later practiced by the Okhrana under Nicholas II. This police control of social life, accompanied by deeds of violence and treachery, not only undermined official morality but literally placed the autocracy at open war with the majority of its subjects. The Third Section continued to exercise its nefarious functions until 1880, when it was abolished by Alexander II, by whom the police administration was transferred to the Ministry of the Interior. Its methods persisted, notwithstanding, in Russian police practice down to the Revolution of 1917, since which they have been largely perpetuated in the Soviet Cheka and G.P.U.

THIRD TERM, an American tradition considered by some writers to have become an unwritten principle of the Federal Constitution, by which a Presi-

dent of the United States is forbidden to succeed himself for a third term. The practice was initiated by George Washington in refusing to allow himself to be reelected a second time. The principle was urged against General Grant and was followed by President Coolidge. Ex-President Roosevelt, however, became a candidate in 1912, after the presidency of Taft, on the theory that another chief executive had intervened, and that furthermore his first term was the unexpired portion of that of McKinley.

THIRTEEN, UNLUCKY, a widespread superstition which may have originated in the old Norse myth of the banquet in Valhalla to which Loki unexpectedly came, making the thirteenth at table, and at which Balder was slain. It may be noted, too, that there were thirteen at table at the Last Supper (Christ and the 12 apostles).

THIRTEEN COLONIES, the colonies in America which were founded by the English, or acquired by Great Britain after their establishment by other nations, and which became the original states of the United States. In the following list, the first date is the year of founding; the second, the date of the fundamental charter: Virginia, 1607, 1606; Massachusetts, 1620, 1629 (Plymouth, incorporated within Massachusetts, founded in 1620); New Hampshire, 1623, 1679; Maryland, 1634, 1632; Rhode Island, 1636, 1663; Connecticut, 1633-36, 1662; North Carolina, 1663-65, 1663; South Carolina, 1663-70, 1663; New York, 1614-23, 1664; New Jersey, 1623, 1665; Pennsylvania, 1643, 1681; Delaware, 1638, 1665; and Georgia, 1732, 1732.

THIRTEEN YEARS' WAR, 1654-67, a term applied to the complex of hostilities between Poland and Russia which began with the submission of the Cossack leader Bogdan Khmelnitzki to Tsar Alexei Mikhailovich, father of Peter the Great, in 1654 and culminated in the truce of Andruszowo in 1667. Apart from the Russian incursion, the Polish Republic was at first threatened simultaneously by invasions headed by Charles X of Sweden and the Elector of Brandenburg. By securing Austrian support, the Poles were able to stave off the Prussian menace, while the Peace of Oliva, 1660, concluded upon the death of Charles X, regulated Polish relations with the Swedes by the cession of Livonia to the latter. The Tsar, who had concluded a truce with Poland in 1656, then resumed military operations. The Polish forces were at first successful in repelling the invaders, but their resistance was weakened by internal dissensions. A series of indecisive hostilities thus dragged on over a period of 10 years, and were finally terminated by the truce of Andruszowo, providing for the retention by Moscow of Smolensk, Siewierz, Chernigov, and the whole east bank of the Dnieper, together with a two-years' occupation of Kiev.

THIRTY-NINE ARTICLES, a formulation of the beliefs of the established Church to which every Anglican churchman must subscribe. They were drawn up in 1562 and by Act of Parliament in 1571 were made the official profession of faith of the

Anglican clergy. It is customary for a new incumbent admitted to a benefice to read the Thirty-Nine Articles publicly as a profession of faith on the first Sunday of his officiation. The Thirty-Nine Articles were adopted in a modified form by the Church of Ireland in 1635, by the Scottish Episcopal Church in 1804, and by the Protestant Episcopal Church of the United States in 1801.

THIRTY YEARS' WAR, a succession of European conflicts, 1618-48, the result of antagonism between the religious leaders of government and the new school of secular leaders, whose appearance in Continental politics was one of the fruits of the REFORMATION. The Protestant revolution made a contest between the laity and the clergy inevitable. Because of the political construction of Europe, the war involved national groups. Although the underlying struggle was a clash between secular and clerical philosophies of government, the surface objectives of the participants were often only remotely associated with the religious ideas and ideals of the Reformation. In fact, at the close of the destructive war religion and morals had sunk to low levels, and had become obscured by the politico-military passion which had motivated the nations engaged.

The opposing religious schools were given political complexion as early as 1608, when the German Protestant princes organized the Evangelical Union, followed the next year by the Roman Catholic League, led by Maximilian of Bavaria. The spark was struck in Bohemia on May 23, 1618, when a Protestant group hurled two Catholic representatives of the Hapsburg Emperor from the windows of the palace in Prague. The Bohemians arose in revolt, and elected the Protestant, Frederick V, as their ruler. The Emperor Ferdinand called upon the Catholic League in 1619, and its army, supported by Spaniards, routed the Bohemians outside Prague on Nov. 8, 1620, whereupon the Hapsburgs regained Bohemia, and disbanded the Evangelical Union. The war might have ended at this juncture had not harassed Protestants in northern Germany obtained the support of Christian IV of Denmark in 1625. This Protestant force was, however, routed by the Catholic general, ALBRECHT VON WALLENSTEIN, at Dessau on Apr. 25, 1626. The Hapsburg armies carried the banners of the Catholic League throughout Germany, and even to Denmark. Flushed with victory, the Emperor Ferdinand in 1629 declared void all Protestant titles to ecclesiastical lands. But the embittered Protestants were slowly gathering strength; the north Germans called in King GUSTAVUS ADOLPHUS of Sweden. In 1631 he was victorious at Breitenfeld; the following year, on Nov. 6-16, he scored a signal victory at Lutzen, defeating Wallenstein. In this celebrated battle Gustavus lost his life. In 1634 Wallenstein was murdered; but, despite his loss, the Catholic armies were victorious at Nordlingen. In 1635 RICHELIEU brought France into the conflict on the Protestant side, declaring war on Catholic Spain. The Swedes were victorious in 1636 at Wittstock, again captured

Breitenfeld in 1642, and during 1643-45 the combined French-Swedish forces scored a series of victories over the imperialists and Saxons. With the tide going against him, the Catholic Emperor was successively deserted by all his allies, excepting Bavaria. The Protestants were planning an invasion of Austria from the north and west, when an armistice ended hostilities. The war was formally ended in 1648 by the TREATY OF WESTPHALIA.

THISBE, a Babylonian maiden loved by PYRAMUS.

THISTLE, the name given to numerous herbaceous plants of the composite family with prickly or spiny foliage. The true thistles comprise a large genus (*Cirsium*) of about 200 species native to the north temperate zone; some 70 are found in North America, widely distributed across the continent. They are usually stout, erect herbs with deeply lobed or cut, very spiny leaves and large, showy flower-heads of purple, yellow or white tubular flowers. Several are pestiferous weeds, as the Canada thistle (*C. arvense*) introduced from Europe. Representative North American species are the roadside thistle (*C. altissimum*), the field thistle (*C. discolor*), the pasture thistle (*C. odoratum*) and the swamp thistle (*C. muticum*), of the eastern half of the continent, and the Indian thistle (*C. edule*), the desert thistle (*C. mohavense*), the western thistle (*C. occidentale*) and the Sierra thistle (*C. californicum*), of the Pacific states. Among other prickly leaved plants known as thistles are the Scotch



PASTURE THISTLE



SAINT THOMAS
From engraving by Martin Schongauer

THOMAS, ST., one of the twelve disciples of Jesus, is thrice spoken of in the fourth Gospel with the addition, "who is called Didymus," or the twin. He is the disciple who said after the resurrection, "Except I shall see in his hands the print of the nails . . . I will not believe," and has ever since been called "the doubter." He is the same

disciple who before Christ's death said to his fellow disciples, "Let us also go, that we may die with him." Legend states that he was a carpenter and builder, and gives many places as the scenes of his labors. In the

History of Mary, one of the apochrypha, he is said to have preached to "the Indians, Chinese, the Cushites, and in all the islands near and far." Others say that he was martyred in India. There has also been confusion regarding his identity, the oldest Syriac tradition of the 2nd century identifying him with St. JUDE. In 394 his bones were enshrined at Edessa. His day is observed by the Latin and Anglican churches on Dec. 21, by the Greek church on Oct. 6 and by the Syriac church on July 3.

THOMAS, AUGUSTUS (1859-), American playwright, was born in St. Louis, Mo., Jan. 8, 1859. He was a page in the Capitol, Washington, studied law, and later became writer and artist in several newspapers in St. Louis and New York. At one time he was editor and proprietor of the *Kansas City Mirror*. His first play was *Editha's Burglar*, from Mrs. Hodgson Burnett's novel, produced at Madison Square Garden Theatre, July 1, 1899. Others include *Man of the World*, 1899; *Alabama*, 1891; *In Miz-zoura*, 1893; *The Meddler*, 1898; *Oliver Goldsmith*, 1900; *Arizona*, 1900; *The Earl of Pawtucket*, 1903; *The Witching Hour*, 1907; *The Copperhead*, 1918; *Nemesis*, 1921. In 1922 he published his autobiography entitled *The Print of My Remembrances*.

THOMAS, CHARLES LOUIS AMBROISE (1811-96), French music composer, was born at Metz, Aug. 5, 1811. A pupil of the Paris Conservatory, where he won the Grand Prix de Rome in 1832, he became its director in 1871 and continued in that post until his death. In 1851 he was elected to the French Academy and in 1868 was created commander of the Legion of Honor. His light and facile pen turned out a score of operas, of which number only *Mignon* and *Hamlet* belong to the modern repertory of large opera companies. He also composed several ballets and a number of excellent male choruses. Thomas died at Paris, Feb. 12, 1896.

THOMAS, GEORGE (1866-), American educator, was born in Hyde Park, Utah, Dec. 29, 1866. He graduated from Harvard in 1896 and did post-graduate work at Friedrich Wilhelm and Berlin universities from 1901-03. Thomas was professor of economics at the Agricultural College of Utah from 1898-1917, and at the University of Utah from 1918-21, when he was elected president of the latter institution. His writings include *Modern Constitutions*, 1907; *Civil Government of Utah*, 1912, and *Development of Institutions Under Irrigation*, 1920.

THOMAS, GEORGE HENRY (1816-70), American soldier, was born in Southampton County, Va., July 31, 1816. After his graduation at the U.S. Military Academy, in 1840, he was engaged in Indian campaigns, and in the MEXICAN WAR was cited three times for distinguished conduct. During 1851-54 he was an instructor at the U.S. Military Academy, and on the outbreak of the Civil War was commissioned colonel in the Union Army. Thomas won the first important Union victory in the West when he defeated General Zollicoffer in Kentucky 1862. He held his own at the bloody encounter of Chickamauga in

1863, and in the advance on Atlanta in 1864 he was second in command under Sherman. When the latter began his march to the sea, Thomas took command of the Union forces in Georgia, Alabama, and Tennessee, and inflicted a terrible defeat on General Hood at Nashville, Dec. 15-16, 1864. In recognition of his services, Thomas was promoted to the rank of a major-general in the regular army. After the war, he was given command of the division of the Pacific. He died at San Francisco, Cal., Mar. 28, 1870.

THOMAS, MARTHA CAREY (1857-), American educator, was born at Baltimore, Md., Jan. 2, 1857. After graduating from Cornell University in 1877, she studied at Johns Hopkins for a year, being obliged to attend the lectures behind a curtain as women were not then admitted. From 1879-83 she studied at Leipzig and received her Ph.D. at the University of Zurich in 1882. In 1884 she was made dean and professor of English at Bryn Mawr College, and in 1894 was elected president, serving until 1922. Under her able administration Bryn Mawr became one of the foremost of women's colleges. Miss Thomas introduced the system of student self-government which has been almost universally adopted, developed a graduate school of great distinction and opened the Summer School for Women in Industry. She has also taken a very active part in the work of the International Federation of University Women.

THOMAS, NORMAN (MATTOON) (1884-), American Socialist, was born at Marion, O., Nov. 20, 1884. He was graduated from Princeton, 1905, and from Union Theological Seminary, 1911. Ordained to the Presbyterian ministry, he preached in New York City until 1918, when he founded and edited *The World Tomorrow*. He became associate editor of *The Nation*, 1921, and director of the League for Industrial Democracy, 1922. He was the Socialist candidate for governor of New York in 1924; for mayor of New York City, 1925 and 1929; and for President of the United States, 1928 and 1932. His publications include *Is Conscience a Crime?* and *What is Industrial Democracy?*

THOMAS, SIDNEY GILCHRIST (1850-85), British metallurgist and inventor, was born at London, Apr. 16, 1850, and studied chemistry while working as a police court clerk. Between 1870 and 1875 he succeeded in devising a process of separating phosphorus from iron in the Bessemer converter by using a basic lining of magnesia. He secured a patent on this discovery and received many scientific honors, including the Bessemer Medal. He died at Paris, Feb. 1, 1885.

THOMAS, THEODORE (1835-1905), American conductor, was born at Essen, Hanover, Oct. 11, 1835. He came to the United States at the age of 10, toured as a violin prodigy, and played in several orchestras. In 1855, with William Mason and others, he organized the Mason-Thomas chamber-music concerts which he conducted for 14 years in New York City. Meanwhile, in 1864, he organized a symphony orchestra in New York which regularly

toured the country during 1869-78. In 1878 he helped to establish the Cincinnati College of Music which he directed until 1880, in which year he returned to New York, becoming conductor of the Philharmonic Orchestra. Three years later he was summoned to Chicago as conductor of the Chicago Orchestra, later known as the Theodore Thomas Orchestra, and remained at that post until his death. In the annals of music in America he occupies a commanding place by virtue of his extraordinary zeal as a propagandist for Wagner, Brahms, Liszt, Saint-Saens, Rubinstein, Richard Strauss, and other European composers whose works were neglected or unknown in the United States. His programs were models of variety and unity, and his readings admirable for their scholarship. He died at Chicago, Jan. 4, 1905.

THOMASVILLE, a city and the county seat of Thomas Co. in southwestern Georgia, about 200 mi. southwest of Savannah. Two railroads and bus and truck lines serve the city. Thomasville has been a famous winter resort for many years. Its retail trade in 1929 reached a total of \$4,510,310. It has lumber mills and various factories. The city lies in the beautiful yellow pine belt of Georgia. The "big oak," which branches out to 110 ft., and the delightful rose gardens are among the attractions of Thomasville. It was founded in about 1826 and chartered in 1889. Pop. 1920, 8,196; 1930, 11,733.

THOMASVILLE, a city in Davidson Co., western North Carolina, situated 18 mi. south of Winston-Salem. Two railroads, bus and truck lines serve the city. Tobacco is the principal crop of the vicinity, and furniture is the important local manufacture. In 1929 the retail trade amounted approximately to \$2,270,000. The city was founded in 1852 and incorporated in 1857. Pop. 1920, 5,676; 1930, 10,090.

THOMPSON, a tribe of North American Indians comprising one of the four great divisions of the

them live. They are divided into the lower Thompsons, living on the Fraser River and the upper Thompson whose territory includes a portion of the Thompson valley, the Nicola River valley and the upper Fraser. They practised no agriculture, hunting and salmon fishing being their main sources of food supply supplemented by roots and berries. Their houses consisted of poles set up in conical form around a hole and covered with grass or cedar bark, with an outside covering of earth.

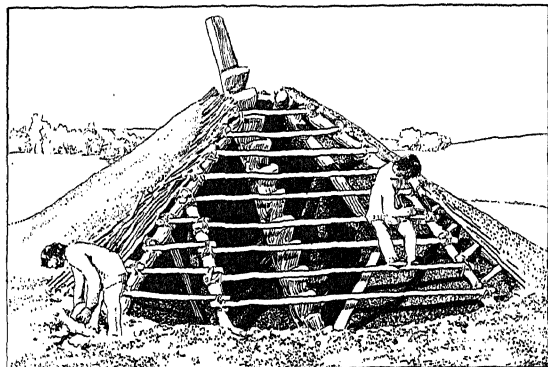
THOMPSON, ERNEST SETON. See SETON, ERNEST THOMPSON.

THOMPSON, FRANCIS (1860-1907), English poet, was born at Preston, Lancashire, Dec. 18, 1860. He was educated at Ushaw Roman Catholic College, studied medicine for a time, and in 1885 went to London. There he fell a victim to poverty, ill-health and drugs. After some years of utter wretchedness he sent a few poems to Wilfrid Meynell, editor of *Merrie England*. The Meynells searched him out and took him to their own home. His *Sister Songs* is dedicated to their children. *New Poems* appeared in 1897. The noble *Hound of Heaven* is perhaps his finest production. Thompson also wrote several prose works, including a *Life of Ignatius Loyola*, 1909. His poetry is frequently colored with his own deep religious convictions, and it is as a distinctly Catholic poet that he is best known. He died at London, Nov. 13, 1907.

THOMPSON, SIR JOHN SPARROW (1844-94), Canadian statesman, was born in Halifax, N.S., Nov. 19, 1844. After holding a series of public offices he became premier of Nova Scotia in 1882, was appointed minister of justice in 1885, and became prime minister of Canada in 1892. He died Dec. 12, 1894 at Windsor Castle. Thompson was an able political leader and a man of high character who would probably have become prime minister following the death of Macdonald in 1891 had he not been a convert to Roman Catholicism. When he did attain that high office his term was too short to display fully the qualities he had already in other positions shown himself to possess. T. P. P.

THOMPSON, WILLIAM OXLEY (1855-), American educator, was born in Cambridge, O., Nov. 5, 1855. He graduated at Western Theological Seminary, Allegheny City, Pa., in 1882, and that year was ordained by the Presbyterian Church. Until 1885 he was pastor at Odebolt, Iowa, and from 1885-89 was president of Longmont College, Longmont, Col., where he also preached from 1885-91. Thompson served as president of Miami University, Oxford, O., from 1891-99 and of Ohio State University from 1899-1925, when he became president emeritus.

THOMSEN, HANS PETER JORGEN JULIUS (1826-1909), Danish chemist, was born at Copenhagen, Feb. 16, 1826. Studying in his native city he became professor in the university in 1866. His principal contributions lie in the field of physical chemistry where he studied the conditions pertaining to chemical reactions, and the changes of heat involved. He was the



COURTESY AMER. MUS. OF NATL. HISTORY

INDIANS OF THE THOMPSON RIVER TRIBE BUILDING A HOUSE
From a model by Ned J. Burns

Salishan linguistic family living in the interior of British Columbia. Their tribal name is Ntlakypamuk but they are popularly called the Thompson Indians from the river along which a large part of

first to compare the relative strength of acids and of bases, and devised a commercial method of making soda. He received many foreign honors and distinctions, and died at Copenhagen, Feb. 13, 1909.

THOMSON, ELIHU (1853-), American scientist and inventor, was born in Manchester, England, Mar. 29, 1853, and was taken to Philadelphia in 1858. He studied at Yale and in 1882 with E. J. Houston, established the Thomson-Houston Electric Co. to manufacture electrical equipment. In 1892 this company merged with the General Electric Co. which controls 700 patents on various devices and improvements invented by Thomson. His chief achievements include electric welding by incandescent methods; the watt-hour meter; the first high frequency dynamo and high frequency transformer; stereoscopic X-ray pictures; the arc light dynamo, and the discovery of the alternating current repulsion phenomena which made possible the use of alternating current motors. Also he made valuable contributions to radiology. He was awarded the Grand Prix in Paris in 1889 and 1900 for electric inventions, and received numerous other honors including the Rumford, Edison, Kelvin and Faraday medals.

THOMSON, JAMES (1700-48), British poet, was born at Ednam, Roxburghshire, Sept. 11, 1700. He was educated at Edinburgh University. In 1726, after going to London, he published *Winter*, the first part of *The Seasons*. *Summer* and *Spring* followed, and in 1730 *Autumn* appeared in the collected series. Among other works, the song, *Rule Britannia*, appeared in his masque, *Alfred*; and there are lively portraits of contemporaries in his *Castle of Indolence*. In a period dominated by artificiality, Thomson wrote of nature from first impressions, and was thus the forerunner of SAMUEL TAYLOR COLERIDGE and WILLIAM WORDSWORTH. *The Seasons* may even be looked upon as the starting point of the whole Romantic movement in literature. See ROMANTICISM.

THOMSON, JAMES (1822-92), British physicist, elder brother of LORD KELVIN, was born at Belfast, Ireland, Feb. 16, 1822. He studied civil engineering at the University of Glasgow. In 1843 he began researches in theoretical science, developing valuable equations in thermodynamics and on the flow of fluids. His inquiries into hydraulics resulted in improvements in water turbines. He became professor of civil engineering at Belfast University in 1854, and in 1874 was appointed professor of engineering at the University of Glasgow. He died at Glasgow, May 8, 1892.

THOMSON, JAMES (1834-82), Scottish poet, was born at Port Glasgow, Nov. 23, 1834. He was educated in orphan asylums. While an army schoolmaster in Ireland he lost a dear friend whose death made him the poet of negation and despair. Poverty and intemperance made his life yet more unhappy. Among his publications are *Vane's Story* and *Other Poems and Essays and Phantasies*. The powerful *City of Dreadful Night* is his best known poem. Thomson was probably not a great poet, but as one

who could express the dark and somber sides of life he has had few equals. He died at London, June 3, 1882.

THOMSON, SIR JOHN ARTHUR (1861-), Scottish naturalist, was born in East Lothian, July 8, 1861. He was educated in Edinburgh, Jena and Berlin. Later he was appointed lecturer on zoölogy and biology at the school of medicine in Edinburgh and in 1899 regius professor of natural history in Aberdeen University. His published works include *Outlines of Zoölogy*, *The Wonder of Life*, *Secrets of Animal Life*, *Science Old and New*, *Science and Religion*, and *Towards Health*. He writes with a charm and simplicity quite unusual in scientific men and both with his books and numerous lectures has done much to make the study of science popular with the layman. He has also advocated the reconciliation of science and religion with great earnestness. Thomson received knighthood in 1930.

THOMSON, SIR JOSEPH JOHN (1856-), British physicist, was born near Manchester, Dec. 18, 1856. He became lecturer in physics at Trinity College, Cambridge, in 1883, and Cavendish professor a year later, succeeding LORD RAYLEIGH. He was appointed in 1905 professor of physics of the Royal Institution in London, and in 1918 became master of Trinity College. Thomson became known not only through his own researches in the fields of electricity and gases, but also as a teacher who made the Cavendish professorship famous. His investigations, which were of profound importance in establishing the electron theory, dealt largely with the electrical conductivity in gases and the determination of the mass and charge of the positive and negative electron. He was elected to the Royal Society in 1884, received the Nobel Prize in physics in 1906, and was knighted in 1908. He was president of the Royal Society in 1916-20, and in 1927 received the Mascart Medal.

THOR or **THORK**, in Scandinavian mythology, god of thunder, was son of ODIN and Frigg and husband of Sif. He was the strongest of the AÆsir gods. His palace was Bilskirnir, where he received the heroes fallen in battle. The rolling of his chariot wheels caused thunder and his hammer, Mjölnir, returned to his hand after he had thrown it. He was at constant warfare with the giants. At the contest between the gods of good and evil, he slew the serpent of Midgard, but died from the poisonous fumes it emitted. He was the national god of Norway, and special offerings were made to him in time of pestilence. Thursday was named for him. He is represented as a young man with red beard.

THORAX, that part of the trunk of the bodies of man and mammals which has a bony wall and lies between the neck and abdomen, containing principally the heart and lungs.

The skeleton of the thorax consists of a vertebral column, ribs and sternum (see SKELETON). The thoracic vertebrae in man are the 8th to the 19th inclusive. Twelve ribs are attached to them on each side, the upper ten being attached also anteriorly to the

sternum, while the pair at the waist are rudimentary. The term thorax (from the Greek *thorax*, meaning armor or corselet) is used also for the corresponding part of bodies of birds, insects and arthropoda.

The thorax in mammals provides a part of the body protected from outside pressure, in which organs whose function depends essentially upon changes in pressure find a place. Pressures outside the thorax are made by air (15 pounds per square inch), by water (in swimming and diving), by abdominal muscles as in defecation and parturition, by activities of the body, in which abdominal pressure is increased because the great muscles of the abdominal walls are always involved.

The walls, in addition to the vertebral column and ribs, consist of muscles and connective tissue, and are part of the general body wall. The floor of the thorax is formed by the diaphragm—a dome shaped muscular partition between thorax and abdomen existing only in mammals. In quadrupeds the fore limbs support the thorax; in bipeds the thorax must support them. These limbs and the shoulder girdle are a weight saddled on its outer surface; this complicates respiration and makes the diaphragm the essential part of the inspiratory mechanism (see RESPIRATORY APPARATUS).

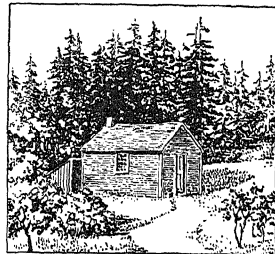
The spinal cord and esophagus extend the entire length of the thorax, the former lying within the vertebral column and the esophagus along its ventral surface, until, piercing through the diaphragm, it enters the abdomen. Other viscera in the large ventral thoracic cavity are the LUNGS, THYMUS and HEART with the great blood and lymph vessels.

The heart, surrounded by the PERICARDIUM, lies in the lower anterior thorax between the lungs. The LYMPHATIC SYSTEM of vessels terminates either in the thoracic duct (left) or right lymphatic duct (right). They empty into veins at the thoracic inlet. These are thin-walled vessels containing valves, and the flow of lymph in them is due largely to suction. During inspiration the great veins at the thoracic inlet "suck" in the lymph from lymph vessels and smaller veins. During expiration, back flow is prevented by the valves. The main active function of the thoracic wall is concerned with RESPIRATION.

The activities of the viscera and vessels of the thorax are regulated by way of the nervous system (vagus and sympathetic). This is ordinarily quite automatic, and requires no conscious effort. B. C. H. H.

THOREAU, HENRY DAVID (1817-62), American writer, was born in Concord, Mass., July 12, 1817. His father, who was of French extraction, engaged in the manufacture of lead pencils. In this he was assisted by the young Thoreau who, after inventing a pencil of superior quality, refused ever again to make another pencil, arguing, characteristically, that he could not repeat himself. He was graduated at Harvard in 1837, and for some time taught school at Concord. In 1839 he made a trip with his brother John down the Merrimac and Concord rivers, writing out of this experience his first book, *A Week on the*

Concord and Merrimac Rivers, published in 1849. Thoreau was supremely fond of walking and of studying nature, particularly birds. In 1845 he withdrew from human society and built his famous hut on the shore of Walden Pond, about 2 miles outside Concord. Here he raised his own corn and beans, baked his own corn bread, Indian fashion, and practically demonstrated his thesis that life can be admirable, simple and harmonious if man will but reduce his desires and needs to a minimum of absolute necessities. The



THOREAU'S CABIN AT WALDEN

Walden episode lasted till 1847, and was the basis for Thoreau's best known book, *WALDEN*, published in 1854. His other works include *Excursions*, 1863, and some scattered verse. As a naturalist Thoreau was less interested in scientific, factual observation than in tracing the subjective thoughts which nature aroused in him. As a writer he developed a style which had in it some of the freshness of the wild life he loved; he is unconventional and stimulating. Thoreau died in Concord, May 6, 1862, and was buried there in Sleepy Hollow Cemetery. See also AMERICAN LITERATURE.

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THORIUM, a metallic chemical element (symbol Th, atomic weight 232.2, sp. gr. 11.2), of the same group as titanium and zirconium, was discovered by Berzelius in 1828. Its chief commercial ore is monazite, a mixed phosphate containing cerium and many other rare earths, and found principally in India; thorium is separated from the other elements by a long and laborious process. It is a grayish-white metal, resembling platinum in its properties, and is used in very small amounts in the tungsten filaments for electric lamps. Its most important commercial use is in the form of its nitrate for the impregnation of incandescent gas-mantles, the combustible fabric of which is subsequently burned, the residue of thorium oxide then giving the well known intense glow. It is strongly radioactive, being the parent substance of a long series of disintegration products, and has a time period of about 13,000 million years. See also RADIOACTIVITY.

W. J. L.

THORN APPLE, a name applied, especially in Great Britain, to the stramonium (*Datura Stramonium*) in the United States more commonly called JIMSON WEED. See DATURA.

THORNDIKE, EDWARD LEE (1874-), American psychologist, was born at Williamsburg, Mass., Aug. 31, 1874. He graduated from Wesleyan University in 1895, from Harvard in 1896 and from Columbia University (Ph.D.) in 1898. The following year he was instructor in education and teaching

at Western Reserve University. In 1899 he went to Columbia University as genetic psychology instructor, becoming adjunct professor in educational psychology in 1901, and professor in Teachers College in 1904. In 1921 he was made director of the division of psychology of the Institute of Educational Research. Thorndike is recognized the world over as an outstanding authority in the field of educational psychology and the leader in the intelligence test movement, which has come into prominence in recent years. He was chairman of the committee on classification of the recruits and officers of the United States army during the World War and was responsible for the introduction of psychological measurement in this work. The intelligence tests have also been used widely to supplement entrance examinations by universities and for purposes of vocational guidance. Thorndike has written extensively on his vast number of experiments in psychological measurement. Among his well-known books are *Educational Psychology*, 1903; *Mental and Social Measurements*, 1904; *The Elements of Psychology*, 1905; *The Original Nature of Man*, 1913; *The Psychology of Learning*, 1914; *The Measurement of Intelligence*, 1926; and *Adult Learning*, 1928.

M. R.

THORNS and **SPINES**, in botany, a sharp protuberance on the surface of a plant. Although the terms are frequently used interchangeably, a thorn is technically a modified stem, leaf, or portion of a leaf, and as such contains vascular tissue, while a spine is an outgrowth of the superficial tissues of any part of the plant and contains no vascular elements. The morphological nature of both is generally shown by their position, thorns arising at the nodes like normal branches or leaves, while spines may be produced on the internodes or the surface and margins of leaves. Thorns occasionally reveal their cauline nature by branching or bearing rudimentary leaves. Both thorns and spines are composed of thick-walled cells closely aggregated into a hard solid tissue. The cause and function of thorns and spines are problematical. It is often supposed that they protect against herbivorous animals, and both are a common feature among desert plants.

H. A. G.

THORNTON, WILLIAM (1761-1828), American architect, was born at Tortola, B.W.I., May 27, 1761, and educated as a physician in England. His systematic education was confined to medicine, but he interested himself in many technical and artistic fields, working on steamboats with Fitch, disputing priority in them with Fulton, painting a still existing miniature of Washington and a lost portrait of Jefferson, and finally devoting his attention to architecture. In 1793 his design for the national Capitol was accepted and he moved to Washington, then in course of construction. A year later President Jefferson appointed him one of the commissioners of the District, and until 1802 he was chiefly responsible for executing the city plan of L'Enfant. The old north wing and the foundations of the center and south wing of the Capitol are of his design, the rest was altered by

later architects, notably Latrobe and Bulfinch. He likewise designed the home of President Madison and the Octagon and Tudor houses in Washington. After 1802 he interested himself in patents, systematized the procedure of their issue, and became the first superintendent of patents. He died in Washington, Mar. 28, 1828.

THORVALDSEN, BERTEL (1770-1844), Danish sculptor, was born at Copenhagen, Denmark, Nov. 19, 1770. He studied at the Academy of Copenhagen, and in 1793 was awarded for his work in sculpture the first gold medal given by the academy, and a scholarship which included three years residence abroad. In 1797 he went to Rome to continue his studies. His first great work, the colossal statue, *Jason*, was highly praised by the Italian sculptor, Canova, and brought success and fame to the young Dane. In 1804 he was appointed professor in the Florence Academy and in 1808 was elected to the Accademia di San Luca, in Rome, becoming its president in 1825. After 23 years in Italy, he spent a year, 1819-20, in Denmark, in which he made the statues of Christ and the Twelve Apostles now in Copenhagen. Returning to Rome, he resided there until 1838, when he once more made his home in his native land. He excelled particularly in relief and in ideal and mythological subjects. His principal works include *Entry of Alexander into Babylon*, *Cupid and Psyche*, *St. John Preaching in the Wilderness*, *Christus Consolatur*, the statue of *Prince Poniatowski*, the medallions *Night and Morning*, and the *Lion of Lucerne*. Thorvaldsen died at Copenhagen, Mar. 24, 1844. His fortune was left to establish the Thorvaldsen Museum of Copenhagen, and he left his art works and models, sketches and studies of all his sculpture to the museum.

THOTMES III (c. 1500-1447 B.C.), Egyptian pharaoh of the 18th dynasty. His parentage is uncertain, but he was probably the son of Thotmes II. For 22 years after his father's death, he shared the government with his remarkable aunt, Queen Hatshepsut, and became sole ruler when she died. Soon after, he commenced a series of wars against Egypt's rivals, and proved himself a military genius of the first rank. He subjugated Syria, Palestine and Phœnicia, and exacted tribute from the rulers of Mesopotamia and the island powers of Crete and Cyprus. In Syria he waged 17 successful campaigns, six of them directed against Kadesh on the Orontes.

Thotmes III was an efficient administrator as well as a great soldier. He consolidated his vast empire into the most powerful country in the world. Under him Egypt reached an extent never surpassed before or after. Much of his enormous wealth was expended in building and repairing temples, especially at Karnak. He died in the 54th year of his reign, and was buried in a rock-hewn tomb in Western Thebes. He is considered the greatest of all the pharaohs.

THOUGHT, LAWS OF, the most elementary principles which thought must observe in order to avoid confusion and to keep from going astray. These are usually known as the principle of identity, of non-

contradiction and of the excluded middle. Stated symbolically they are expressed as follows:

A is A. (identity)

A is not not-A (noncontradiction)

Everything is either A or not-A (excluded middle)

These so-called laws of thought once occupied a prominent position in the textbooks of elementary logic and were regarded as fundamental to straight thinking. Now, however, they are considered by many so elementary as to have little importance. Perhaps they may save the thinker from error but they do not help him greatly in arriving at truth. The principle of identity may be cited as an example. The only significance it can have lies in the fact that a logical subject must remain sufficiently identical with itself to be intelligently discussed. If the statement were to be taken absolutely, all thinking would be impossible. In a world of change things are never quite the same from moment to moment, yet they do remain sufficiently stable to be referred to for all intents and purposes, as the same object. If this were not true we should continually find ourselves involved in the kind of controversy typified by the problem of whether or not a man is the same individual after he has had his hair cut. R. N. B.

BIBLIOGRAPHY.—F. C. S. Schiller, *Formal Logic* (1912).

THOUGHT TRANSFERENCE, a synonym for TELEPATHY carrying the additional implication that the contents of ideas or emotions may be conveyed by supernormal means without reduction to sensory images. It is not to be confused with MIND READING or MUSCLE READING, which depend on some form of code or slight muscular indications.

THOUSAND ISLANDS, a group of about 1,700 small islands and islets in the St. Lawrence River between the province of Ontario, Canada and Jefferson and St. Lawrence Cos., N.Y. The islands are situated at a point in the river where it expands in length and width as it emerges from Lake Ontario. The picturesque beauty of the islands makes them a favorite spot for many elaborate American and Canadian estates. See also ST. LAWRENCE ISLANDS PARK; BRODER PARK.

THRACE, a name given to various areas of the northern part of the Balkan Peninsula. At the time of Herodotus it comprised a region bounded on the north by the Danube, on the south by the Propontis and the Aegean, on the east by the Pontus Euxinus and on the west by the Strymon River and Illyrium. The territory was divided by Mt. Haemus. The region between the Strymon and the Nestus rivers was annexed by Macedonia under Philip of Macedon, father of Alexander the Great. As a Roman province in the days of the Empire, Thrace covered the territory bounded on the west by the Nestus, north by Mt. Haemus, east by the Euxine and south by the Propontis and the Aegean. For the most part the Thracians were a warlike people, although several of the Greek poets and philosophers came from Thrace. The custom of selling children and buying wives was

practiced by the Thracians. The Greeks established numerous colonies in Thrace, among them being Abdera where Democritus was born. Eumolpos, the originator of the Eleusinian Mysteries, came from Thrace. At the present time this region is partly under the jurisdiction of Greece, the remainder being governed by Turkey.

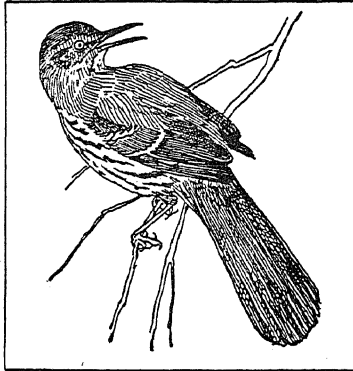
THRACIAN, an extinct INDO-EUROPEAN language preserved in a number of glosses, many personal and geographical names, and two hexameters in Greek letters on a gold ring found in 1912 near the Bulgarian village of Ezerovo. It belonged to the *satem*-group (see SATEM-LANGUAGES), and seems most nearly akin to PHRYGIAN, ILLYRIAN, MESSAPIAN and ALBANIAN.

THRACIANS, a people inhabiting in ancient times the region between the Danube, the Black Sea and the northern Aegean. Their entire lack of political genius prevented these half-barbarous tribes from forming any common government, and they have no continuous history. Greek colonists who penetrated Thrace in the 7th century B.C. were sometimes compelled to pay tribute; sometimes, as Miltiades of Athens, invited for the sake of trade. Neither Darius in 513 B.C. nor Xerxes in 480 B.C., on invading Europe, met resistance from them, and they fought against the Greeks at Platæa. In the PELOPONNESIAN WAR they sided with Sparta, but they invited Athenian assistance, in 357 B.C., in their struggle with Philip II of Macedonia. Conquered by him, they shared the difficulties of that country, although occasionally aiding Rome against her, until Macedonia became a Roman province, 146 B.C. Thrace, nominally independent, had relations to Rome comparable with those of India to England; her occasional impulses to revolt were easily quelled, until Vespasian, 69-79 A.D. constituted the Roman province of Thrace. The country suffered constant invasion and devastation under the Empire, although the eastern capital, Constantinople, was within its borders.

THRALE, MRS. HESTER LYNCH. See PIOZZI, HESTER LYNCH.

THRASHER, a genus (*Toxostoma*) of thrushlike song birds of the mockingbird family (*Mimidae*) native to North America. There are some 20 forms, mostly 10 to 12 in. long, with decurved bills, short, rounded wings, long tails and stout feet. The brown thrasher (*T. rufum*), one of the best known song birds of eastern North America, breeds from southern Canada to the Gulf states, and winters from Virginia southward. It is an active bird, about a foot long, reddish brown above and white streaked with dark brown below. Shy by nature, it frequents shrubberies and thickets, usually concealing in a dense bush its twiggy nest, in which it lays three to six thickly speckled, whitish eggs. Although feeding to some extent upon seeds and fruit, the brown thrasher performs valuable service to agriculture by destroying many noxious insects. The very melodious song of the male is softer and less varied than that of the mocking bird and is seldom imitative of the notes of

other birds. Numerous allied species are found in the western and southwestern States, among which are the California thrasher (*T. redivivum*) and the crissal thrasher (*T. dorsale*).



G. M. SUTTON, "BIRDS OF PENNSYLVANIA,"
J. HORACE McFARLAND CO. COPYRIGHT
BROWN THRASHER

THREAD CUTTING, the machining or cutting of SCREW THREADS in a hole or on a bar. It is done with TAPS AND DIES, by the milling process using either a single cutter or a hob, and with a single point tool in a LATHE.

THREAD MANUFACTURE. The manufacture of COTTON sewing threads requires the use of all grades of cotton from the longest staple Sea Island and Sakellaridis to the low grade short staple. The longest staple makes the best grades of threads and can also be spun finer for the finer numbers. While the longest staple can be used in the coarse count to give strength, the lower grade fibers make lower grade threads.

In the manufacture of the cottons into sewing threads, the cotton is opened or prepared for the carding very much the same way and with about the same operations that are required in the manufacture of cloth. That is, it is carded, combed (combing is required for better grade threads) drawn out and spun to the correct size. From the spinning operation the single ends are put together as many as required to make a certain number of thread and twisted together in the reverse direction from the spinning. Reversing the direction gives balance to the twist to keep from kinking. Cable twist is made by first twisting two single ends together, then reversing the twist with as many strands as required to make a certain number of thread. Threads are not numbered by the number of strands but rather by the diameter of the twisted strand.

Since most of the thread used is either black or white, it requires FINISHING. First it is thoroughly boiled out to remove the greases and waxes. It is then dyed (see DYEING) or bleached (see BLEACHING) as the case may be. It is finally wound on spools (see SPOOLING) or packages, whichever is suitable for the purpose it is to be used. W. R. W.

THREADWORM, the popular name for members of a class (*Nematoda*) of unsegmented worms which

generally have elongated cylindrical bodies. Some species are of microscopic size while others attain a length of 3 ft.; the females are always larger than the males. Threadworms include a great variety of small free living forms, the best known of which is the vinegar eel (*Anguillula aceti*), and numerous parasites. Among the latter are the hookworms (*Ancylostomidae* and *Strongylidae*); trichina; the guinea worm (*Dracunculus* or *Filaria medinensis*); and the blood parasite (*Filaria sanguinis hominis*) which causes elephantiasis. Many of the parasites have very complicated life histories. A good example is that of trichina. The adult inhabits the intestinal tract of rats, pigs, man and certain other animals, where the eggs are laid. The larvæ make their way to the muscles, where they encyst. They cannot continue their development unless their host is eaten by an appropriate second host. Man becomes infested by eating uncooked pork.

THREE KINGDOMS, PERIOD OF THE, the period in Chinese history from approximately 200 to 280 A.D. when the Wei dynasty ruled in the north, the Wu dynasty in the lower Yangtze region and the Minor Han dynasty in the west. The heroes of this period, particularly Kuan Yu, later worshiped as the god of war, and Tsao Tsao, became romantic figures.

THREE MILE LIMIT, the suggestion of Bynkershoek in 1703 that the territorial limits of a nation should be established at a distance which the state was able to control by its shore batteries, i.e., the range of an ordinary cannon. It was estimated at three miles, and this tradition has become generally accepted in international law as the proper limit. Some states hold tenaciously to this limit. Others regard it as totally inadequate under modern conditions, and argue for a four, six, ten or twelve mile limit. Where a state insists upon a four-mile limit as regards itself, captures by a belligerent (see BELLIGERENCY) within the four mile zone, but without the three mile limit, are not illegal. The United States and Great Britain agreed by treaty under date of Jan. 23, 1924, "to uphold the principle that three marine miles extending from the coast-line outwards and measured from low-water mark constitute the proper limits of TERRITORIAL WATERS. C. E. MA.

THREE MUSKETEERS, THE, a popular romance by DUMAS THE ELDER; published 1844. It is the first volume of a trilogy dealing with the thrilling adventures of D'Artagnan, the bold Gascon. About 1625, the time of Louis XIII, D'Artagnan arrives in Paris where he begins his career by dueling with the king's bravest musketeers, Athos, Porthos and Aramis. He wins the friendship of the three and henceforth shares in their exciting adventures, the first of which takes them to England where they recover from Buckingham a diamond necklace for their queen. Time and again the musketeers are almost trapped by Lady de Wintars, the crafty spy of Cardinal Richelieu, and only at the last do they put her to death. Second in the trilogy is *Twenty Years After*, 1845, which was followed by *The Vicomte de Bragelonne*, 1848-50.

THREE PRINCIPLES OF THE PEOPLE, the principles laid down by SUN YAT-SEN as the foundation of the program for the reconstruction of China, called in Chinese the "*San Min Chu I*." The three principles as defined in Sun's book, which has become somewhat the "bible" of the KUOMINTANG, are: the principle of nationalism, the principle of democracy and the principle of livelihood. As defined by Dr. Sun, "The principle of nationalism is equivalent to the 'doctrine of the state.' The Chinese people have shown the greatest loyalty to family and clan, with the result that in China there have been family-ism and clanism but no real nationalism. . . . The unity of the Chinese people has stopped short at the clan and has not extended to the nation." In discussing the principle of democracy, or of the "people's sovereignty" as Dr. Sun sometimes called it, Dr. Sun says that "man and all living beings have in these two hundred thousand years gone through a process of gradual evolution to form our present world. What age have we now reached? The age of the people's power, the age of democracy. Our principle of livelihood is communism and it is socialism. . . . It is not a form that originated with Marx but a form that was practiced when primitive man appeared upon the earth. . . . Livelihood is the driving power in all social movements; and if livelihood does not go right, social culture cannot advance, economic organization cannot improve, morals will decline, and many injustices such as class war, cruelty to workers, and other forms of oppression will spring up. . . . All social changes are effects; the search for livelihood is the cause."

BIBLIOGRAPHY.—Sun Yat-sen, *San Min Chu I*, translated by F. W. Price, edited by L. T. Chen, 1927; A. N. Holcombe, *The Chinese Revolution*, 1930.

THREE RIVERS (Trois Rivières), a city, the capital of St. Maurice Co., and a port of entry of Quebec, Canada, situated on the St. Lawrence River at the mouth of the St. Maurice River, 75 mi. northeast of Montreal. Served by the Shawinigan Falls and other hydroelectric developments, it is the outlet of an important lumbering district, and manufactures pulp and paper. It is said to be one of the largest paper making centers in the world. Foundry products derived from bog iron ore of the region, grain and cattle are transshipped. Founded by Champlain in 1634, Three Rivers in 1908 was almost completely destroyed by fire, but has been substantially rebuilt. Pop. 1921, 22,367; 1931, 35,450.

THREE RIVERS, a city in St. Joseph Co., southwestern Michigan, situated 25 mi. south of Kalamazoo, at the meeting point of the St. Joseph, Portage and Rocky rivers. The city has connections with the Michigan Central and the New York Central railroads. Its various industries include the manufacture of railroad cars and drug and leather products. Three Rivers was founded in 1830 and incorporated in 1895. Pop. 1920, 5,209; 1930, 6,863.

THREE WISE MEN, THE, the "Three Kings of Cologne," Gaspar, Melchior and Balthazar, who

followed the star to Bethlehem to pay their homage to the new-born Christ. They are better known as the MAGI.

THRESHERS, machines which separate grain, such as wheat, flax and beans, from the straw and chaff. In most threshers the kernel is loosened from the straw by a rapidly revolving toothed cylinder working in coordination with stationary concave teeth. The free kernels drop through grates onto a grain pan. Loose kernels still remaining in the straw are removed by shakers. Chaff and the lighter weed seeds are removed from the threshed grain by sieves and an air blast from a fan.

Stationary machines are used for threshing grain that has been cut with a binder or header and assembled by wagons or trucks. Threshers with a cutting mechanism attached, called COMBINES, accomplish cutting and threshing in one operation. Power to operate threshers is usually furnished by steam or internal-combustion engines.

A. J. S.

BIBLIOGRAPHY.—H. P. Smith, *Farm Machinery and Equipment*; J. B. Davidson, *Agricultural Machinery*.

THRIFT, a name applied to the common SEA PINK (*Statice Armeria*), an evergreen perennial native to various regions of the world and widely cultivated in numerous varieties for its attractive flowers.

THRIPS, a term correctly applied only to minute insects of the order *Thysanoptera*. The adults are winged or wingless, the winged forms having four long narrow wings fringed with long hairs. Their mouth-parts are fitted for piercing and sucking. The terminal joint of the tarsus is bladder-like, a peculiarity of this order. Certain species of thrips are often very injurious to cultivated plants. On onions they cause the disease called white blast. Other species attack cabbage, tobacco, strawberry and pear. Wheat, rye, oats and other grasses show "silver top" when heavily infested. Heads of clover are sometimes destroyed. In California citrus fruits, prune, almond, cherry, peach and nectarine suffer from attacks of these insects. The greenhouse thrips also causes great damage. Spraying with contact insecticides is more or less effective as a means of control.

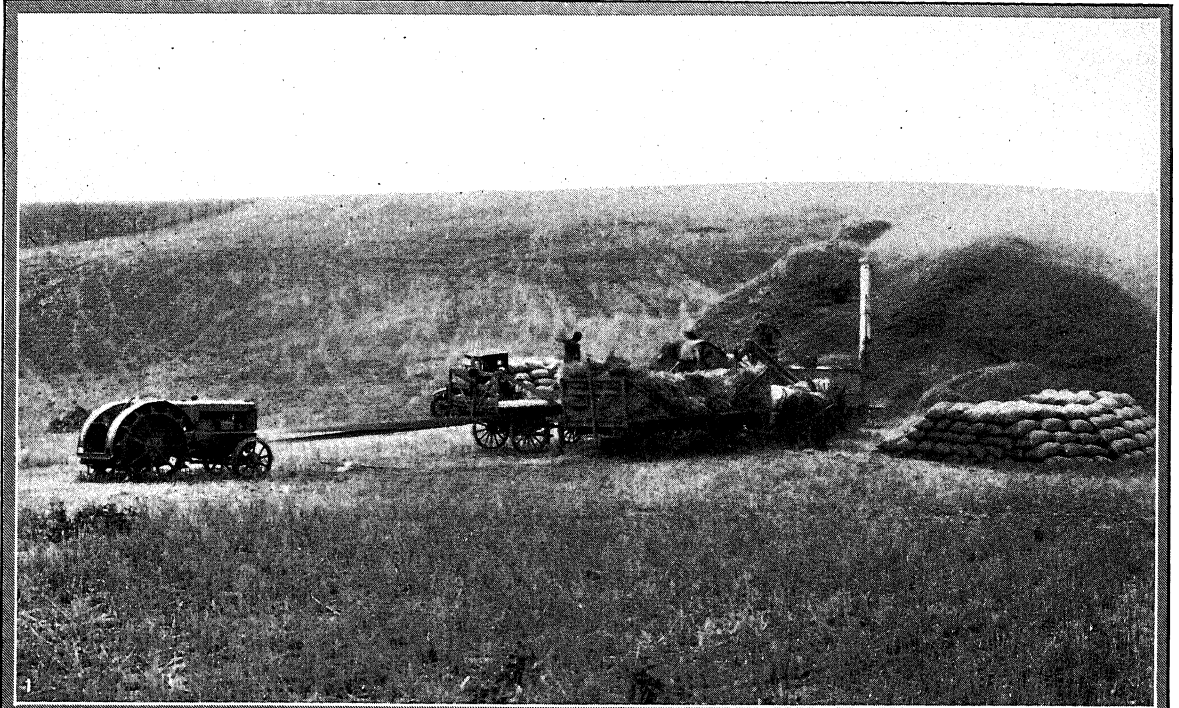
THROAT, DISEASES OF THE. See ADENOIDS; PHARYNGITIS; TONSILLITIS.

THROMBO-ANGIITIS OBLITERANS. See NEUROSURGERY: Sympathetic Nerves.

THROMBOSIS AND EMBOLISM. Thrombosis consists of the formation of a solid mass or plug in some location within the heart or blood vessels. The mass is made up of substances from the blood and usually consists of a blood clot. Embolism consists in the blocking of a blood vessel by a clot of foreign matter *carried* to it by the circulation.

Thrombosis may occur in any blood vessel, but is most common in the vessels of the *leg*. It may be produced by increased coagulability or altered concentration of the blood. Injuries to the blood vessel walls together with slowing of the blood current are also factors. The thrombosis may follow infections of the blood vessels.

THRESHERS



COURTESY J. I. CASE CO.

MODERN THRESHING MACHINES

1. A time-saving outfit threshing wheat on the Great Plains.
2. A high-powered thresher on a modern 1,000-acre farm.

The symptoms of thrombosis are illustrated by interference in veins of the leg. There may be some pain in the affected vessels. There is edema or collection of excess fluid in the tissues of the leg. The vein becomes tense and does not pit much on pressure. The leg may be pale and cold, or red and hot. The acute symptoms usually subside after a week.

Treatment of thrombosis consists in rest, drugs to relieve pain, and an ordinary light diet. Later, massage, movement and electrical treatments may be employed.

Embolism is common in the *lungs* following operations, being fatal about once in every thousand operations. Lesser grades are about ten times as frequent. The onset of symptoms is sudden, with pain in the chest and shortness of breath. In the severe forms consciousness develops and death occurs in a few moments. In less severe forms cough and expectoration of blood-tinged sputum develops.

The distinguishing factors of embolism are that young adults are affected more often than elderly persons, the onset is sudden, unconsciousness is rarely deep, and convulsions are commonly present. The distinguishing symptoms of thrombosis are the presence of premonitory symptoms, gradual onset, and the absence of convulsions. Paralysis usually occurs.

The treatment of embolism consists of putting the patient to bed with the foot of the bed slightly raised. Stimulants are given for feeble heart action.

Embolism and thrombosis also occur in the blood vessels in the *brain*. The emboli are usually carried in the heart.

Thrombosis occurs as a result of hardening of the arteries in old age, from syphilis affecting the arteries, from swellings of the arteries known as ANEURYSMS from pressure upon the blood vessel by a tumor. There is degeneration and softening of the area of the vein deprived of blood.

There may be no symptoms if silent areas of the brain are affected. In general, the symptoms resemble those of APOPLEXY.

W. I. F.

THROOP, GEORGE REEVES (1882-), American educator, was born in Boydsville, Tenn., Jan. 24, 1882. He graduated from De Pauw in 1901 and took his Ph.D. at Cornell University in 1905. From 1905-07 Throop was professor of Greek at Illinois College. In 1907 he joined the faculty of Washington University, where he taught Latin and Greek until 1917, was Collier professor of Greek from 1921-27, acting chancellor from 1927-28, and became chancellor in 1928.

THROOP, a borough in Lackawanna Co. in northern Pennsylvania, situated on the Lackawanna River, 3 mi. northeast of Scranton; served by two roads. Coal mining is the important industry. Throop was incorporated in 1894. Pop. 1920, 6,672; 1930, 8,027.

THROWING, a series of silk manufacturing operations by which strands of raw silk (see SILK AND SILK MANUFACTURE) are combined into threads of suitable size and condition for WEAVING and KNIT-

TING. It consists mainly of placing several strands side by side and TWISTING them together.

THRUSH. See MOUTH, DISEASES OF.

THRUSH, a bird of the cosmopolitan family *Turdidae*. They are mostly woodland birds, are greatly diversified in size, plumage and voice, are migratory, feed mainly on insects and small fruits, nest in trees and bushes, or on the ground and many species are inclined to associate with mankind. This family contains many of the best known song birds of the world; it is rivalled only by the sparrow family, yet not all thrushes sing well. Among the famous songsters among the thrushes of the Old World are the mavis, or song-thrush, the British "black-bird," the various nightingales, and certain of the



G. M. SUTTON. "BIRDS OF PA." J. HORACE McFARLAND CO. COPYRIGHT

WOOD THRUSH

many small species locally prized. None excel in musical ability the hermit and wood thrushes of the eastern United States and Canada, although the most familiar thrush, the misnamed robin, and the bluebird give only short chants. The solitaire belongs to the Rocky Mountains, and represents a group of tropical American solitaires which some consider the most entrancing singers in the bird-world. The music of all thrushes is clear, sweet, far-carrying and instinct with a pure and lovely quality.

E. I.

THUCYDIDES (? - c.390 B.C.), celebrated Athenian historian, was born some time between 471 and 454 B.C. He came of a wealthy and influential family, and possessed in his own right gold mines in Thrace. The year 431 B.C. marked the commencement of the Peloponnesian War, which forms the subject of his famous history. A year later he was taken with the plague that broke out in Athens, but recovered, and in 424 he commanded a part of the Athenian fleet off the Thracian coast. In consequence of his failure to arrive in time to save the city of Amphipolis from falling into Spartan hands, Thucydides was forced into banishment for 20 years. He was recalled to Athens about 403 B.C., and is believed to have met a violent death at Thrace several years later.

During the period of his exile, Thucydides laboriously collected most of the materials for his life-work, the *History of the Peloponnesian War*, consisting of eight books. Doubt has been cast on the authorship of the eighth book. The history shows Thucydides to have been most scrupulous and diligent in ascertaining facts; these are set down concisely in a calm, clear and impartial manner. Despite his regard for brevity, however, he was not content merely to narrate occurrences accurately, but sought to trace their causes. His power of critically analyzing characters and events adds much to the value of his work.

Thucydides is considered the founder of philosophical history, and one of the foremost historians of all time.

THUG, a word derived from the Hindustani *thag*, pronounced tug, meaning a "cheat," or "knave." It came to have a specific meaning with reference to robbers and assassins, either Hindu or Moslem. Indian thugs, as known to the West, were stranglers by means of the noose (*phansi*). They were in earlier times numerous throughout India, even professing to act with the sanction of the goddess Kali whom they worshiped with special rites before a strangling venture. The story is fully told in M. Taylor's *Confessions of a Thug*, 1839. About a century ago the Indian Government took measures to imprison and wipe out these murderous bands.

THULIUM, a metallic chemical element belonging to the RARE EARTHS, its chemical symbol being Tm, its atomic weight 169.4. It was discovered by Cleve in 1879, and occurs in very small quantities in the mineral gadolinite. Its salts are pale green in color, and give a characteristic absorption spectrum in solution.

THUN, an ancient city of Switzerland in the canton of Bern on the Aare River near Lake Thun. It is Switzerland's chief artillery dépôt with barracks and drilling ground. Above the city rises the massive tower of the Zahringen-Kyburg Castle, built in 1182, with an historical museum. Thun produces metal goods and cheese, has cattle fairs and trades in agricultural products. Pop. 1930, 16,428.

THUNDER, the loud noise following a flash of LIGHTNING. It is caused by the sudden heating and the resultant expansion of the air by the powerful electric discharge. From the difference in time between the perception of the flash and the hearing of the thunder the distance of the occurrence may be estimated. The speed of light, 186,000 miles per second, is so great as to propagate the flash almost instantaneously; the velocity of sound, however, is only about 1,000 feet per second. Hence a difference of 5 seconds between flash and sound reception indicates a distance of a mile, roughly speaking.

The production of rain in a thunderstorm is now considered to be the primary phenomenon, the electric discharge being of secondary importance. A thunderstorm may originate in a number of ways, the more usual being that where a current of moist warm air meets with and is forced upward by a current of cold air, or where the moisture from the ground is carried upward by convection until it is cooled enough to condense. In both instances the cumulo-nimbus, or typical thundercloud, a towering, vertical structure, is formed. The redistribution of the electric charges on the raindrops inside the cloud then produces the electric potential, which in turn causes the lightning. As soon as the rain begins to fall, however, the electricity is discharged quietly, and lightning often ceases. Moisture is essential to the formation of thunderstorms. They do not occur in arid deserts, but in the tropics may happen on as many as six days out of

ten. It is estimated that over the whole earth some 2,000 thunderstorms are in progress at any one time.

THURIBLE (Latin *thus*, frankincense), a metal vessel in which incense is burned at various services, especially at High Mass and Benediction. It has a separate lid for the pan containing incense and charcoal. Three chains attached to the vessel itself are used to carry or swing the thurible, and a fourth raises the lid.

THURINGIA, a central German federated state, formed in 1919 by the merger of the former states Saxe-Weimar-Eisenach, Saxe-Gotha, Saxe-Altenburg, Saxe-Meiningen, Reuss, Schwarzburg-Rudolstadt and Schwarzburg-Sondershausen. Total area, 4,527 sq. mi. The south and southeast are occupied by the Thuringian forest, the northeast by off-shoots of the Erz Mountains and the north by the Rhön Mountains. The country is drained by the Saale River and its tributaries into the Elbe in the north, the Werra system to the northwest and a small southern section by tributaries of the Main River. There are nine towns with populations between 20,000 and 100,000. Industry and trades predominate, although there is considerable agriculture and cattle raising. Brown coal, potash salts and slate are present, and the chief manufactures are china, glass, iron and metal wares, optical and precision instruments, textiles, wooden goods and toys. Thuringia has a democratic government with legislative power vested in a Diet, having, in 1929, 69 members. Pop. 1925, 1,609,300.

THURINGIANS, a Germanic tribe among the allies of Attila. Their first known King, Basin, in the 5th century ruled over a territory extending south from the Saxon plain to the Danube and west to the Rhine. The Frankish King, Clovis, annexed the western portion of this territory in 491. Their last King, Hermanfried, married the niece of Theodoric the Goth, with whose aid he staved off the Frankish conquest until Theuderich I of Austrasia defeated him in 531, ending Thuringian independence.

THURSDAY ISLAND, a small island of Queensland, Australia. It is situated in the Torres Strait, about 30 mi. northwest of Cape York. It is a center for pearl-fishing. Port Kennedy is the chief town and seaport. Pop. 1926, 1,700.

THYME, a numerous genus (*Thymus*) of small, shrubby plants of the mint family, several of which are grown as garden ornamentals, are used for seasoning or yield valuable medicinal oils. There are about 50 species, natives of temperate climates but most numerous in the Mediterranean region. They are erect or creeping perennials with a pungent mintlike odor, entire leaves and small flowers borne in loose axillary or terminal clusters. The common thyme (*T. vulgaris*), native to southern Europe and very widely cultivated, grows about 8 in. high with slender whitish branches bearing narrow sessile leaves and dense clusters of purple flowers. The plant is a source of thymol widely used in medicine; the leaves, either green or dried, are used in seasoning. The wild thyme (*T. Serpyllum*), called also creeping thyme, with much

branches, prostrate stems and oblong, short-stalked leaves, is a native of the Old World widely naturalized in the United States. It is often planted for edgings and in rock gardens.

THYMOL, a white crystalline solid occurring in many ethereal oils, and obtained technically from Ajowan oil. It has also been prepared synthetically. The principal uses of thymol are as a mild antiseptic, in mouth washes, sprays, etc., and as an intestinal worm destroyer. Di-iodothymol and other derivatives also have antiseptic properties. E. H. V.

THYMUS, an irregular mass of lymphoid tissue at the front of the root of the neck, extending down into the chest to the heart and between the lungs. It is relatively largest in the infant at about the time of birth, after which it gradually decreases in size until puberty, after which its involution is rapid. Microscopically it is seen to be composed of lymphocytes or of cells resembling lymphocytes (*see* BLOOD), together with a small amount of connective tissue holding the lymphocytes together.

In spite of considerable investigation, the function of the thymus in the higher animals is unknown. It is thought by some to secrete a hormone which inhibits normal development, while it permits growth in size. From its structure it would seem to be an organ for the production of the white cells of the blood.

THYRATRON, a three-element, gas-filled electronic tube used as a relay to control electrical power. It is also used to convert high-potential ALTERNATING CURRENT to direct current, and vice versa.

THYROID GLAND, one of the glands of internal secretion, situated in the front part of the neck, and consisting of two lobes, one on each side of the trachea. The two lobes are connected by a narrow band or isthmus which passes in front of the windpipe. The thyroid gland has no duct or external secretion. Its secretion passes directly into the blood, its action depending upon an organic compound containing iodine.

The active principle of the thyroid secretion was isolated by Kendall in 1919 and has been named thyroxine. Thyroxine is a colorless, odorless, crystalline substance containing 65% iodine.

The diseases produced by abnormalities of the thyroid gland may be due to absent or deficient secretion, or to excessive or altered secretion. Tumors of the gland also occur, or the gland may become so enlarged as to produce pressure upon surrounding tissues. Enlargement of the thyroid gland is called goiter.

The secretion of the gland acts normally as a regulator of the metabolism, or the building up of tissues and the burning of material in the body for producing energy. When there is a deficiency of the thyroid secretion, the metabolic processes are sluggish; when it is excessive, they are greatly hastened. The disease produced by deficiency depends upon whether it was present at birth or developed later in life. **CRETINISM** develops when the thyroid secretion is deficient at birth. **MYXEDEMA** is a similar disorder caused by

thyroid deficiency usually occurring between the sixteenth and sixtieth years.

In certain localities, notably in Switzerland, a large proportion of the population have **GOITER**. It seems to have been conclusively shown that this simple enlargement of the gland is due to lack of iodine in the drinking water and diet of those who live in these regions. It has also been shown that if iodine is given to these individuals in proper doses, the development of goiter will be prevented. Except for disfigurement and inconvenience, simple goiter is without symptoms.

Alteration or excess of the thyroid secretion produces the disorder commonly called toxic goiter with increased heart beat, increased metabolism, excessive perspiration, nervousness and irritability. W. I. F.

THYSANOPTERA, the scientific name for an order of insects, popularly known as thrips. They are slender, and usually very small, many species being less than $\frac{2}{5}$ in. long. Most thrips are found on plants, whose juices they suck, but a few feed on the body juices of other creatures. Some species lack wings; others have narrow wings fringed with hairs. Among many thrips the eggs may develop without fertilization, and in some cases, males are unknown.

THYSANURA, the scientific name for an order of primitive wingless insects, known popularly as bristle-tails. They are of small size, and are distinguished by long tail filaments and feelers. The most familiar species is the silver-fish (*Lepisma saccharina*). It is less than $\frac{1}{2}$ in. long, and is covered with tiny glistening scales, which give it a silvery appearance. This insect is found in buildings, usually among old books and papers, or in the kitchen.

THYSSEN, AUGUST (1842-1926), German industrial leader, was born at Eschweiler, May 17, 1842. He engaged, with his brother, Josef, in the iron industry in Duisburg, and, after 1871, established, in Mülheim, the firm Thyssen & Company. From this, developed one of the largest European concerns of its time, employing approximately 20,000 men. In 1903, the brothers founded the Stahlwerk Thyssen A.G. und Gewerkschaft Jacobus, and built up a metal trust, which included interests in raw materials, transportations and power. Having lost to France his interests in the Lorraine iron fields (1918), Thyssen reorganized the trust in 1919. He died Apr. 15, 1926.

TIARA, originally the high, stiff headgear, surrounded by a diadem, of the Persian kings; later, the high papal crown, at first a bulbous, helmet-like cap of white material with a golden circlet set with jewels around the base, which was replaced by a crown in the 13th century. Boniface VIII who died in 1303, added a second crown. A third crown followed, being mentioned in 1315.



PAPAL TIARA
From a 15th century Italian miniature

Thus was completed the triple papal crown (*triregnum*). In its present form it is about 15 in. high, of cloth of silver with the three golden crowns and pendant white *infulae* or *candae* (black until the 15th century) and surmounted by an orb bearing the cross. The tiara is worn by the pope at his coronation and other functions of non-liturgical nature. When pontificating, he wears a *MITER*. The tiara most frequently symbolizes the threefold office of priest, pastor and teacher, or the Church Militant, Triumphant and Suffering.

TIBERIUS (Tiberius Claudius Nero Caesar) (42 B.C.-37 A.D.), Roman Emperor, son of Tiberius Claudius Nero and Livia Drusilla, was born at Rome 42 B.C., several years before his mother married Augustus. Through her influence, Tiberius rose rapidly to authority, and after participating in some successful military campaigns, was made Roman consul at the age of 28. In 11 B.C., Augustus compelled him to divorce his wife, Vipsania Agrippina, and marry the emperor's daughter, Julia, from whom he later separated. Augustus subsequently adopted him as his heir. During the wars against the Germans, Tiberius served with great distinction and received a splendid triumph at Rome in 11 A.D. Upon the death of Augustus, 14 A.D., he ascended the throne and began a reign remarkable for its perplexing contradictions. On the one hand, he had many constructive laws passed, took care that his governors did not impose excessive taxation on the provinces, and lightened the financial burden of Rome itself by practicing a rigid economy. On the other hand, the historian Tacitus describes him as a man of ruthless tyranny and cruelty. It is true that Tiberius was unpopular with the ruling faction in the Senate. Modern scholarship is inclined to hold that Tacitus wrote his account of the emperor from the point of view of this faction. Tiberius left Rome in 26 and took up his permanent residence first in Campania, and later on the island of Capri, entrusting the administration of the empire to his favorite, Sejanus, whose villainies became intolerable. Sejanus met his fate in 31, when he was slain at Tiberius's command. On Mar. 16, 37, at Misenum, the aged Emperor died. He was succeeded by his adopted son, Gaius Caligula.

TIBER (Italian *Tevere*), the largest river of central Italy, called in Latin *Tiberis* and in Italian *Tevere*. The famous stream rises on Monte Fumaiolo, in the Tuscan Apennines, 4,160 ft. above sea level. In a winding course it flows southward, partially forming the boundary between Umbria and Lazio. After traversing the Roman Campagna, the river twists its way through Rome and empties into the Tyrrhenian Sea, 21 mi. below Rome, through two mouths, at Ostia and Fiumicino. The river's length totals 253 mi.; its breadth at Rome is about 250 ft.; and its depth from Rome to the sea, the most navigable part, is from 7 to 20 ft. The main tributaries are the rivers Paglia, Nera and Teverone. Swift in its course, the Tiber is famed for its tawny or mustard color, caused by the heavy sediment it carries. At its two mouths

this sediment is deposited at the rate of from 10 to 13 ft. a year. The Tiber has frequently overflowed its banks. Since 1876 embankments have been built and rebuilt at Rome as protection against the disastrous inundations.

TIBET also **THIBET**, a dependency of China lying to the southwest of that country, bounded on the west and south by India and on the north and east by the Chinese provinces of Sinkiang, Chinghai and Hsikiang. Tibet embraces an area of 463,000 sq. mi. and forms the most elevated extensive country in the world. The region consists of a vast system of mountain uplands, which in the west reach heights of 18,000 ft. above sea level and in the east 15,000 ft. The loftiest peak in the entire region is a spur of Mt. Karakorum in western Tibet. It rises 24,000 ft. above the sea. Some of the largest rivers in the East have their sources in the Tibetan mountains; among these rivers are the *INDUS* and the *GANGES*. Hundreds of lakes, many without outlets and of salt water, are scattered throughout the interior. Among the best-known of the lakes are Tengri-nor, Yamdok-tso and Manasarowar. All of them lie at elevations upwards of 15,000 ft. Western Tibet, and parts of the north, are of desert character and destitute of any form of vegetation. In these sections there are no streams. The eastern regions are watered by powerful streams which cut across the walls of the mountains. The climate of the greater part of the province, however, is bleak and cold and vast spaces still remain unexplored. In southern Tibet the climate becomes pleasant in the summer and it is here that wheat, barley and other cereals are grown, as well as a variety of fruits, especially apricots, peaches and walnuts. In some favored parts even grapes are cultivated. In most inhabited regions the chief pursuits are pastoral. Sheep, yak, buffaloes, pigs, oxen, horses and mules are the domestic animals.

There are practically no industries in Tibet. Wool spinning, knitting, weaving and the making of images for the religious edifices are among the commonest occupations. Metal working is also carried on. Tibet has a variety of minerals, among the more important of which are gold, borax, salt, niter, iron, silver, copper, turquoise and lapis lazuli. The exports are precious metals, woolen fabrics, furs, borax and salt. The trade is chiefly with China and British India and the transport is very difficult, since the products are carried by yak and sheep over mountain passes 14,000 to 18,000 ft. high.

According to an estimate of the Chinese Post Office in 1923, Tibet had a population of about 2,000,000. Lhasa, the capital and largest town, has a population of about 20,000. The Tibetans, a branch of the Mongol race, adhere to the form of Buddhism known as Lamaism, of which the Dalai Lama, who resides at Lhasa, is the head. The Dalai Lama is also the head of the Tibetan government.

TIBETAN, the chief member of the Tibeto-Burman group of the SINO-TIBETAN linguistic family, although its relationship to CHINESE is thus far by no

means clear. A characteristic feature is the coalescence of prefixes with nouns, this apparently being a remnant of an early mode of derivation. These prefixes when combined with a verb sometimes form causatives and transitives, as *nad-pa*, "ill"; *s-nad-pa*, "to wound"; *rin-pa*, "long"; *s-rin-pa*, "to lengthen." The syntactic order is subject, object, verb, and words in the genitive precede those which govern them. Nouns are unchangeable in principle; but this is not true of verbs, modes and tenses being expressed not only by affixes, particles and auxiliaries, but also by modifications in the root, as *gañ* "full"; *'geñs-pa*, "to fill"; perfect *b-kañ*, future *d-gañ*, imperative *k'on*. The script, is of Indian origin. J. J. L. D.

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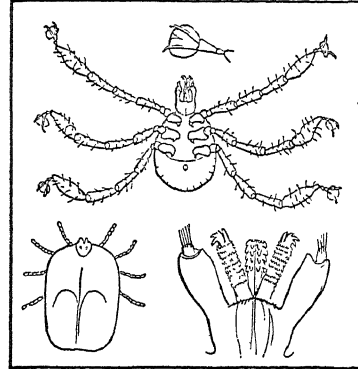
TIBULLUS, ALBIUS (c. 54-19 B.C.), Roman elegiac poet, flourished in the 1st century B.C. Little is known of his life. An estate at Pedum which he inherited was confiscated during the Civil Wars, but he recovered part of it, and spent the better part of his short but happy life there. He accompanied his chief friend and patron, M. Valerius Messala, on the latter's campaign in Aquitania in 30 B.C., but illness prevented him from again accompanying Messala on a mission to the east in 28 B.C. The first two of the four books of *Elegies* bearing Tibullus's name are chiefly devoted to his unworthy mistresses, "Delia" and "Nemesis." The third book is believed to be the work of another poet, and the authenticity of the opening poem of the fourth book is also doubted. Tibullus's poetry possesses a charming simplicity and grace free from the pedantry affecting other elegiac literature. See also ELEGY; LATIN LITERATURE.

TIBUR, Tivoli, an ancient city of Latium in Italy situated on the left bank of the Anio, a tributary of the Tiber, which here forms a waterfall. When Latium finally fell to Rome in 338 B.C., Tibur became a subject town. Just outside the city, Hadrian had a villa of 160 acres containing many statues, fine marbles and whole pavements of mosaic. See TIVOLI.

TICINUM, the modern PAVIA, an ancient city of Italy, in Gallia Transpadana on the River Ticino, 18 mi. south of Mediolanum, or Milan. Founded by the Ligurii, who had vast stores of grain there, the city gained in importance after the empire. The Padus was navigable from this point, and there were important road connections with the Via Aemilia. Attila and Odoacer ravaged Ticinum; Narses, after capturing the city, lost it to the Lombards who made it their capital. Frederick Barbarossa and other German kings received the crown of the Lombards at Pavia.

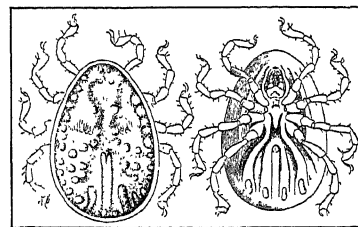
TICK, the common name for members of two families, *Ixodidae* and *Argasidae*, of an arachnid order (*Acari*) which includes the mites. Usually their bodies are oval in shape, and from about $\frac{1}{8}$ to $\frac{1}{2}$ inch long. They have a toothed probe, hypostome, on their heads, with which they pierce and fasten themselves

to the skin of mammals, birds and reptiles, while they suck the blood of these hosts. The females of some species are capable of enormous distention, being almost four times larger when gorged with



WHITE-SPOTTED MOOSE TICK
(*Ixodes albipictus*). Top, foot with sucking disc. Middle, six-footed young. Bottom left, adult, natural size, gorged with blood. Bottom right, mouth-parts

blood than when unfed. Many ticks infect their hosts with dangerous diseases. Among them are two which cause fevers in man, the Rocky Mountain spotted-fever tick (*Dermacentor venustus*), which carries a protozoan blood parasite (*Babesia hominis*), and *Ornithodoros moubata*, found in Africa, which carries the spirochaete that gives rise to relapsing fever. Other ticks carry organisms which cause biliary fever



DOVE TICK
(*Argas reflexus*). Dorsal and ventral, enlarged

in dogs, heart-water sickness in sheep, Texas or red-water fever and coast fever in cattle, and spirillosis and other diseases in fowls.

TICK, TEXAS CATTLE, the common name for a species (*Boophilus* or *Margaropus annulatus*) of tick that infests cattle in America, Australia and South Africa inoculating them with Texas or red-water fever. The body is brown, oval and about $\frac{1}{8}$ inch long in the male, and yellowish or slate-colored, elliptical and nearly $\frac{1}{2}$ inch long in the full-fed female. A protozoan blood parasite (*Babesia bigemina*) carried by the tick, is the actual cause of disease.

TICKER, a small machine operated by TELEGRAPH from a stock exchange or trading center to print the prices of securities and commodities and important news concerning the market. It comprises a printing wheel rotated by a polarized relay and escapement in synchronism with a transmitter at the exchange, and

a neutral relay which presses the tape against the printing wheel. The transmitter consists of a rotating cylinder with pins helically arranged around it. The operator manipulates a keyboard, and as a key is depressed it catches the corresponding pin and momentarily stops the cylinder. The cylinder is provided with a commutator which reverses the battery current several times per revolution to actuate the polarized relay and printing wheel on the ticker. As the cylinder is stopped the printing wheel stops with the proper letter in position. Then, as the current passes through the line in the proper direction the neutral relay on the ticker operates to print the letter and move the tape forward. Several transmitters are usually operated together by a perforated tape; and several tickers are generally connected in series on one circuit.

TICKNOR, GEORGE (1791-1871), American scholar and writer, was born at Boston, Mass., Aug. 1, 1791. He graduated from Dartmouth, studied law and then traveled abroad from 1815-19. After his return he became Professor of Modern Languages and Literature at Harvard, but resigned in 1835. Ticknor's principal work, *The History of Spanish Literature*, was published in 1849. His life of William Prescott appeared in 1864. His *Life, Letters and Journals* was published posthumously. Ticknor's interest in the subject had led him to collect a notable library of Spanish literature, and this was bequeathed to the Boston Public Library after the scholar's death in Boston, Jan. 26, 1871.

TICONDEROGA, a village and township in Essex Co., northeastern New York. It is situated between Lake George and Lake Champlain, 100 mi. northeast of Albany. Lake steamers and the Delaware and Hudson railroad serve the city. Potatoes, grain and apples are produced in the vicinity, and paper is the chief manufacture. The village is rich in historical associations. SAMUEL DE CHAMPLAIN discovered the lake which bears his name in 1609. The fort was built by the French in 1755, and during the French and Indian War the vicinity was the scene of several engagements. Montcalm took Fort William Henry, situated on Lake George, in 1757 and Viscount George A. Howe was killed here two days before the storming of Fort Ticonderoga in 1758. The English took possession about 1759. During the American Revolution Fort Ticonderoga was attacked several times, but was abandoned in 1781 and fell into decay. It has been largely restored. Ticonderoga became incorporated as a village in 1889. Pop. 1920, 2,102; 1930, 3,680.

TICONDEROGA, BATTLE OF, May 10, 1775, an engagement of the REVOLUTIONARY WAR which resulted in an American victory. Ft. Ticonderoga, commanding the stream linking Lake George and Lake Champlain, a location of great strategic importance, had been weakly garrisoned by the British since the close of the FRENCH AND INDIAN WAR. Ethan Allen and 83 backwoodsmen, his GREEN MOUNTAIN BOYS, effected a surprise capture after gaining entrance to

the fort by a ruse. Crown Point, the fortress on Lake Champlain, surrendered shortly after to Seth Warner, like Allen a Vermont backwoodsman. These captures delivered a large quantity of ammunition and several cannon into the hands of the Americans.

TIDAL EVOLUTION, the change brought about in celestial systems, and more particularly in the system moon-earth by the influence of the tides. It appears that a few billion years ago the earth rotated upon its axis much faster than it does now, while the moon, being much closer, also circled much more quickly around the earth than it does now. The *day* at that time was only about five hours long, the *month* but slightly longer.

Through the friction due to the tides raised by the two bodies mutually, the system gradually developed into its present state, where the day is 24 hours long and the moon revolves around the earth in a month of 27½ days. This is not yet final, and in the future the motions of the earth and the moon will continue to be slowed down by the tides until eventually, after many billions of years, the day and the month will again be of the same length, approximately 47 of our present days.

W. J. L.

TIDAL POLE, a primitive instrument for measuring the height of the tides, and consisting simply of a graduated stick planted in the water. It has now been replaced by a tide-gauge, which is composed of a tank built inland, but in open communication with the sea, in which a surface float, connected with a wire and a magnifying indicator, shows the exact height of the water level.

TIDAL POWER, water power developed from sea water stored at high tide and released through water turbines (*see* TURBINES, WATER) at low tide. The success of any tidal-power project depends upon a large range of tide and on means of furnishing power during time of rising tide and periods of small tidal range. Small tide mills have been built, but the tides have not yet been harnessed on a large scale. Plans have been prepared for their large-scale utilization on the Severn River in England and in Passamaquoddy Bay on the coast of Maine.

In tidal power plants, the surplus power available at high tide is generally used to pump water to higher levels for use as a reserve at low tide. However, in the *Shishkoff* type of tidal power plant, the surplus power is used to generate heat by a brake on the generator shaft. This brake is regulated by a governor to consume all the power that is not needed by the generator. The heat which the brake generates raises the temperature of water to about 390° F. and it is stored in a steam accumulator. Then at low tides, this is taken from the accumulator and used to drive a turbine and ELECTRIC GENERATOR unit. F. K.

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TIDAL WAVE, a name which is usually and incorrectly applied to any sudden and destructive wave running far up the shore of seas or lakes, and flooding as well as devastating large tracts of land. The

tidal waves are invariably due, and can usually be traced to some severe commotion caused by a violent earthquake or hurricane. The great earthquake of Messina in 1908 produced a wave of this kind which reached heights of nearly 40 feet and wrought much destruction. The floods occasionally occurring on the Texas coast of the Gulf of Mexico have been the result of extremely powerful hurricanes in the Caribbean. A tidal wave proper, being produced by the tides, can be predicted in advance. In places where it reaches large proportions, owing to the peculiar shape of estuaries or shallow bays, it is known as a **BORE** or **EAGRE**.

TIDES, the periodic rise and fall of the water level of the seas and oceans of the earth, with resultant changes in the depth of the water and in the direction and speed of the currents near the shore. These tides are due principally to the attraction of the moon, and in a smaller measure to that of the sun. The water on that side of the earth which is turned toward the moon is attracted more strongly than the center of the earth because it is nearer the moon. Similarly the water on the far side is attracted less strongly. As a result, this water on the far side is "left behind" so to speak; that directly toward the moon is pulled forward and the liquid envelope of the earth has a tendency to become elongated and form a bulge on both sides. Thus there will be high tide at both places which are opposite each other, and these two simultaneous high tides will follow the moon in its motion around the earth.

The effect of the rotation of the earth on its own axis, combined with the revolution of the moon around the earth, is to cause the moon to complete its circuit of the heavens in an average of about 24 hours, 51 minutes. In this interval there will thus be two high tides, and a high tide occurring at noon one day will recur the next day at 50 minutes past. The sun has a similar effect, but although its mass greatly exceeds that of the moon, its distance is so much greater that its tide-raising force is less than half that of the moon. Near new moon, when the sun and moon are seen in the same direction from the earth, and at full moon, when they are in opposite directions, the two high tides produced by both coincide in time and position. The result will be very high tides with very low tides in between, the spring tides. At first quarter and last quarter, the sun and the moon are seen in directions which make a right angle with each other. Under those circumstances the tide raising force of the sun works at cross purposes with and partly destroys that of the moon, and the neap tides result.

At places away from the equator there is a diurnal effect in the tides, as is easily seen from the fact that in latitude 30° north e.g. the moon may pass nearly overhead at the time when it has reached its highest declination, while 12 hours later it will not pass directly through the nadir, but be only some 30° below the northern horizon. Just before and after spring tides the interval between two successive high waters

is smaller than the average value, while around the neap tides it is larger, phenomena which are known under the names priming and lagging. It should be emphasized that the tide is not constituted as a huge wall of water which runs around the earth in 25 hours. Nothing could withstand the destructive power of such a flood. It is chiefly a wave motion, an up and down oscillation, around an equilibrium position, with the water never deviating much from its original neighborhood and always returning to that neighborhood.

There is a considerable lag between the time of high water and that of the moon's transit, due to the effect of the moon's force on the water being greater some distance outside the meridian. The average interval of time between those two instants is known as the lunital interval, while the average value of this interval in any given locality on days of new moon and full moon is called the establishment of the port.

The problem of calculating and predicting the tides is one of the most complex in all science, and is usually tackled by assuming, in first approximation, that the earth is covered by an ocean of uniform depth which takes up its equilibrium position under the tide raising forces instantly. In the further refinement the periodicities of the various forces acting are then introduced as known from astronomical theory. To obtain the amplitudes of the tides actual observations of high and low water are used.

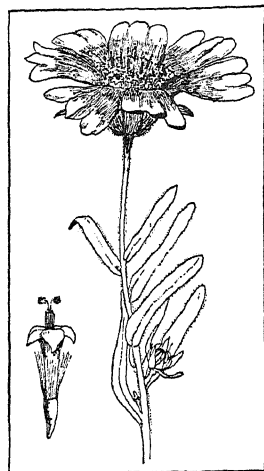
In the open oceans the rise and fall of the tides averages some 2-3 feet. Along the coasts it is usually larger, while in shallow bays or estuaries of rivers the range may be enormous and reach up to 50-70 feet, as in the Bay of Fundy. The phenomenon is then known as a **BORE**, or **EAGRE**. In inland seas and lakes the tidal effect is very small, and the so-called **SEICHES** appearing as tides are caused by changes in air pressure and winds. During the time when the waters are rising and flowing toward the land the tide is said to be flood, while after high tide when the flow is away from the land the phenomenon is called ebb.

The tides may cause considerable friction in shallow seas and narrow straits, especially in such seas as the Bering, Irish and Malacca seas, and the Northwest Passage. This friction causes the rotation of the earth to slow down; but the actual amount, as derived from astronomical observation, is no more than about $1/1000$ of a second per century, though even this minute amount indicates that tidal energy is dissipated at the rate of two billion horsepower.

In addition to the well-known and easily observable tides in seas and oceans, the solid crust of the earth is subject to an entirely similar oscillation which may equal nine inches at spring tides. From this may be concluded that the rigidity of the earth as a whole is about equal to that of steel. Similar tides also occur in the atmosphere, where they manifest themselves as a variation in barometric pressure of around $1/100$ of an inch.

W. J. L.

TIDYTIPS (*Layia platyglossa*), a handsome annual of the composite family, common in valleys and foothills in southern California. It grows about a foot high bearing somewhat hairy, more or less divided leaves and showy flower-heads with numerous bright yellow, white-tipped rays. The similar yellow tidytips (*L. elegans*), with yellow- or sometimes white-tipped rays, and the white tidytips (*L. glandulosa*), with white or rose-tinted rays, both natives of the Pacific states, are cultivated as ornamentals.



FROM JEPSON, MAN. FL. PLANTS CALIF., COPYRIGHT

TIDYTIPS
(*Layia platyglossa*). Single flower and branchlet with flower-head

TIECK, JOHANN LUDWIG (1773-1853), German poet, novelist and critic, was born at Berlin, May 31, 1773. His works are representative of the German Romantic movement. *William Lovell*, 1795-96, is a long, gloomy novel of deepest despondency. In *Volksmärchen*,

1797, the philosopher turns from rationalism and proves by means of fairy tales that there is a deeper mystery in the universe that can be solved by the use of reason; this collection included the famous *BLUEBEARD* and *PUSS IN BOOTS*. In his dramas Tieck fashioned a world of dream and wonder, full of the supernatural, symbolism and medievalism. In later novels he passed under the influence of Goethe's *WILHELM MEISTER*. A collection of his critical writings was issued in 2 volumes in 1848. Tieck died at Berlin, Apr. 28, 1853.

TIENTSIN, extensive mountain ranges of central Asia, one of the many long mountain folds that, starting out in more or less parallel lines from the great central nexus of the *PAMIRS*, traverse Eastern Asia in a generally southwest-northeast direction. Of these the Tien Shan range shuts off the Ili valley from the Tarim basin, of which it forms the northern boundary, and at the same time separates the south road, Tien Shan nan-lu, from the north road, the Tien Shan peh-lu. Connected with the mountains of Kokand and Tashkent farther west, and starting from about the meridian of Kashgar (75° E. long.), the Tien Shan, or Celestial Mountains, in their eastern prolongation in the Bogdo-ula, extend as far as the 96° E. long., where they terminate in low hills which gradually disappear, sinking under the sands and clays of the Gobi Desert. Some geographers state that the system extends from the Aral-Caspian depression (67° E. long.) to the bend of the Hwang-ho (103° E. long.).

From time immemorial the Chinese have possessed two roads, and two only, connecting them with the west, with Turkestan and Central Asia. The north

road leaves China proper by the province of Kansu, passes out of the town of Hami and thence down the Ili River valley, past Kulja, and into the Turkestan plain and the regions to the east of the Aral Sea. The road south of the Tien range leads through the basin of the Tarim, along the banks of which it passes. As Kulja is the immediate objective, coming from China, of the Ili or north road, so Kashgar and Yarkand are the objective points of the Tarim or south road.

The vast Tien Shan system is about 1,500 mi. long east and west, with an average width of nearly 250 mi., and a total area of 400,000 sq. mi., or rather more than that of all the European highland systems taken together. Igneous life is extinct, and no trace is now found of the active volcanoes spoken of by early explorers. The mountain chain proper starts east of the Hami Oasis and extends unbroken westwards far beyond the Tarim Basin, and throughout forms its northern rampart. This is the dividing line between the central and northern tracts of Central Asia. The leading passes include the Barkol Daban and the low saddles of Tashihto and Tapancheng at either end of the Bogdo Ula massif. Farther west are routes leading down to the cultivated tracts of Kucha, Aqsu and the open valley of the Taushquan Darya, as well as via the Terek and Turug Art passes to Kashgar.

The whole system of the Tien Shan continually expands westwards, developing two or more lateral and parallel ridges, and in the extreme west ramifying into several distinct branches which spread out like a fan far into the Turkestan lowlands. Of these the most southwestern are the Alai and Trans-Alai which stretch in parallel lines for 240 mi. along the northern edge of the Pamir, down to the Turkestan plains. They are separated from the Tien Shan proper by the Kogart and Terek-davan passes (in the Tien Shan, *art*, *davan*, *bel* and *kutal* are the general names for passes; the *art* is a high and dangerous gap, the *davan* a difficult, rocky defile, the *bel* a low, easy pass, the *kutal* a wide opening between the hills), but their diorite and granite formations show that they belong none the less to the Tien Shan system. The most important western branch of the Tien Shan are the Alexander Mountains, which run at an elevation of 15,000 ft. from the closed basin of Lake Issik-kul along the northern edge of the Narin valley. The great peaks of the range are Khan Tengri (22,440 ft.) and Nicholas Mikailovich (22,670 ft.). The height of these summits surpass all others of the region by 3,000 ft. Many of the crests of the Tien Shan are above the line of perpetual snow, and it is probable that several peaks of 20,000 ft. exist on the central ranges. The outer ranges do not have summits above 16,000 ft.

In the forests of the Tien Shan the prevailing trees are the mountain ash and spruce (*Picea Schrenkiana*). The spruce occurs as far as 8,000 ft. above sea level.

TIENTSIN, a treaty port and the most important commercial city in China Proper north of Shanghai.

It is the only important port of Hopei Province, and formerly was the seat of the provincial government. It connects with the sea by the Pei River, and by rail with Manchuria, Peiping, Hankow and Shanghai. It also is on the Grand Canal. Nearby to the north are the large Tongshan and Kaiping coal fields.

The Chinese city for centuries has been a thriving commercial center. Since Tientsin was opened to foreign trade by treaty in 1860, it has developed rapidly as an international trade center. A series of treaties gave territorial concessions in Tientsin to the British, French, Japanese, Italians, Germans, Russians, and Belgians. The Germans lost their concession as the result of China's entry into the WORLD WAR; the Russians lost theirs following the Soviet Revolution; the Belgians returned theirs to China by agreement in 1929. Tientsin has been the scene of a number of clashes between Chinese and foreigners. The Tientsin massacre directed chiefly against the French occurred in 1870, as the result of the circulation of stories that the French Sisters of Charity kidnapped children and used their bodies to make medicine. During the BOXER UPRISING in 1900, the foreign residents were besieged by the Boxers, the city being in turn attacked and taken by the allied foreign troops, July 14. A number of minor clashes between the Japanese and Chinese have occurred in the neighbor-

hood of the Japanese Concession in recent years, one of the most serious being that which took place in December, 1931.

Tientsin has developed rapidly as an industrial and trading center during the past decade. It is the principal export market for the furs of North China and the principal import market for manufactured goods and machinery for the same region. There now are a number of important flour and cotton mills in Tientsin. Pop. 1929, approximately 800,000.

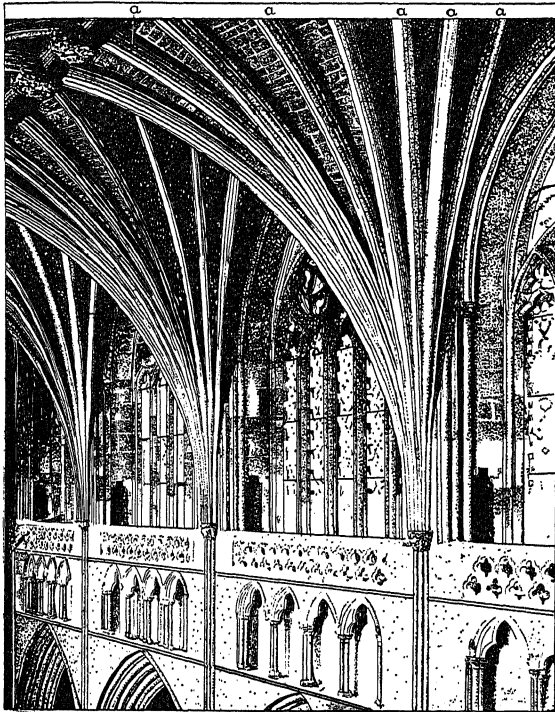
TIERCERON, in Gothic architecture, any intermediate vault rib which rises from the support to the ridges of the vault, between the main cross rib and the chief groin rib. The multiplication of tiercerons is an important element in the richness of English Gothic church interiors. The clustering ribs of the 14th century vault of Exeter Cathedral are typical. See **GOthic ARCHITECTURE**.

TIERRA DEL FUEGO, a chain of islands separated from the southernmost end of South America by the Strait of Magellan. Of the total area of 28,000 sq. mi., over a third belongs to Argentina and the rest to Chile. The archipelago consists of one very large island, East Tierra Del Fuego, which measures 270 mi. in length, and numerous lesser ones. Late in the 19th century gold was discovered on the main island but development proved unprofitable and agriculture and live-stock raising are now the principal industries. Immense flocks of sheep are bred. Wool is the chief export. Tierra Del Fuego was discovered by Magellan in 1520. Population of the Argentine section, 2,504 and of the Chilean, 28,000.

TIETON DAM, located on the Tieton River, 30 miles west of Yakima, Wash., is the highest existing earth dam in the world, being 222 feet high above the bed of the river. It has a concrete core wall extending from bed rock to the top of the dam, a height of 321 feet. The top width of the dam is 40 feet and the thickness at the base 1110 feet. The volume of the dam is 1,995,000 cubic yards and it is 905 feet long on top. It creates an irrigation storage reservoir of nearly nine billion cubic feet capacity. The spillway is a concrete lined channel adjacent to one end of the dam. F.K.

TIFFANY, CHARLES LEWIS (1812-1902), American jeweler, was born at Killingly, Conn., Feb. 15, 1812. He was educated at Plainfield Academy and when 25 years old went to New York where, with John B. Young, he established, at 259 Broadway, a store which retailed fancy-goods, including jewelry. In 1847, the firm began to manufacture jewelry and the following year took advantage of a slump in the European diamond market to become dealers in diamonds. Six years later the firm became Tiffany & Co., with a branch in Paris, and it later established a branch in London and a watch factory in Geneva. Mr. Tiffany dealt in historically famous gems and became a leading authority on precious stones. He died in New York, Feb. 18, 1902.

TIFFIN, a city of northern Ohio on the Sandusky River, about 50 mi. southeast of Toledo, and the county seat of Seneca Co. It is served by three railroads and by interurban bus lines. Heidelberg University is here, also the National Home of the Junior Order of the United American Mechanics. Tiffin is



TIERCERON VAULTING
Nave of Exeter Cathedral, England. a, Tiercerons

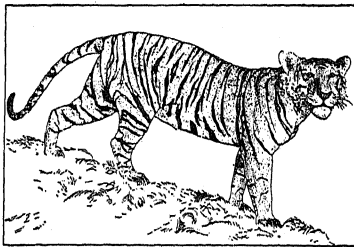
hood of the Japanese Concession in recent years, one of the most serious being that which took place in December, 1931.

Tientsin has developed rapidly as an industrial and

the center of an industrial district, with manufactures which include tools, glass, elevating and hoisting machinery, church furniture and gloves. In 1929 the value of the factory output was about \$12,000,000; the retail trade amounted approximately to \$9,250,000. Tiflis was founded in 1814 and incorporated in 1827. Pop. 1920, 14,375; 1930, 16,428.

TIFLIS, capital of the Georgian Republic and of the Transcaucasian S.F.S.R., in the extreme south-eastern part of European Russia. It is an outstanding cultural and commercial community, picturesquely located on a treeless plateau above the Kura River. The Kura divides the city into north and south parts which are connected by eight bridges. The quaint Asiatic section has a skyline of pyramid-shaped church domes; the European section is modern. Tiflis derives its name from the Georgian word meaning hot, which refers to its renowned hot springs. As the Georgian capital since the 5th century, on the trade route from Europe to India, it has weathered the invasions of Khazars, Huns, Persians, Arabs, Mongols, Turks and mountain tribes. From the 12th to the 15th century it was the capital of a large domain which included almost the entire Caucasian area. After partitions between Turks and Persians, a Russian protectorate was established in 1783, with annexation following in 1801. Tiflis was the capital of the White army during the civil war following the 1917 revolution. Important manufactures are tobacco, oil, soap, brick, leather goods and furniture. The metropolis has numerous museums, educational institutions, palaces and churches. The ancient Zion Cathedral and several medieval religious edifices are historically interesting. The market section is very colorful and the bazaar is usually crowded with people whose native attire and manners indicate the region's Oriental character. Pop. 1930, 320,000.

TIGER (*Felis tigris*), a great Asiatic cat, one of the largest and most powerful beasts of prey. Although long ago styled "Royal Bengal" by circus owners, Bengal is not the tiger's only or particular



COURTESY AMER. MUS. OF NATL. HISTORY

TIGER, FEMALE

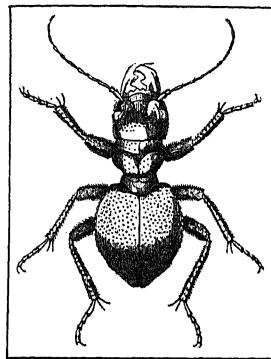
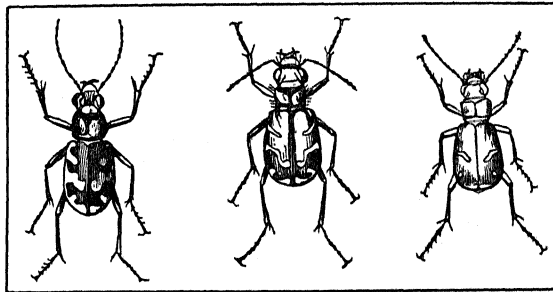
home, for this animal, varying considerably in adaptation to local climate and conditions, is found from the mountains of western Persia to Java, China, eastern Siberia, and throughout India and Ceylon. It is royal, however, in frequently exceeding the lion in length (9 to 10 ft.), weight and agility. The tiger differs from the lion chiefly in absence of mane, and

in its richly furred, bright yellow, beautifully black-striped coat.

The tiger's natural prey include nearly every creature in the jungle except the elephant and wild bull, but in lands, as India, abounding in men and domestic animals it has an additional and sure food-resource, and constantly ravages the herds and flocks. Occasionally a tiger, not always old and decrepit, learns how easy it is to seize human prey, and thus becomes a "man-eater," terrorizing a large neighborhood. In their forays tigers exhibit great speed and boldness of attack, make astonishing leaps, and display enormous strength, habitually dragging (not carrying) heavy bodies into some chosen retreat. On the whole they show greater cunning, sagacity and courage than does the lion.

Despite their enormous strength tigers reared from infancy by intelligent persons may be easily managed in captivity, and exceptionally may become so friendly with keepers whom they know as to be harmless and even affectionate toward them, and willing to learn and perform stunts in public. They breed in captivity and are regarded as the grandest objects in every menagerie. As a game animal the tiger ranks the noblest in the world. See also LEOPARD. E. I.

TIGER BEETLE, the popular name for many brilliantly colored beetles of the family *Cicindelidæ*. The name "tiger" suggests the predaceous habits of the larvæ. In sandy places or in well-trodden paths they construct vertical burrows. Here they lie, with their heads near the entrance, ready to seize any passing insect. A pair of forward-curving hooks on the abdomen helps the larva to maintain its hold on the walls of the burrow. Adult beetles of the more

TIGER BEETLE
Manticora maxillosaTIGER BEETLES (*Cicindela*)*C. generosa**C. tranquebarica**C. purpurea*

common species are metallic green, blue or brown in color, often with small light spots on the elytra. They are long-legged, agile insects. When disturbed, they fly a short distance and alight facing the source of disturbance.

TIGERT, JOHN JAMES (1882-), American educator, was born at Nashville, Tenn., Feb. 11, 1882. He graduated from Vanderbilt University, 1904, and from Oxford University in 1907. Tigert was professor of philosophy at Central College, Fayette, Mo., 1907-09; president of Kentucky Wesleyan College, 1909-11; and professor of philosophy and psychology, University of Kentucky, 1911-21. He was United States Commissioner of Education from 1921-28, when he became president of the University of Florida.

TIGHINA (Bender), a Rumanian city and capital of a district in Bessarabia. It is the chief port on the Dniester River with a good trade in lumber, grain, wool, wine and cattle. Founded as a Genoese colony in the 12th century, the Turks captured it with Moldavia. It was taken by Russia in 1812 and was returned to Rumania in 1918. Pop. 1930, 31,698.

TIGRĒ, a SEMITIC language of the South ARABIC group spoken in northern Abyssinia. Like ETHIOPIC, which it superseded, it has two tenses, perfect and imperfect, and two forms of the plural, "sound" and "broken"; but unlike the former, its pronoun for the third person has *h-* instead of *w-*.

TIGRIÑA, a SEMITIC language of the South ARABIC group spoken in Abyssinia. Like TIGRĒ, it developed from and superseded ETHIOPIC, but is more strongly influenced in grammar, syntax, and especially in vocabulary by AMHARIC than is the former.

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TIGRIS, a river of southwestern Asia. It rises in the mountains of Armenia, swells into a big river after passing the Diarbekr plain, and flows down through stupendous gorges of limestone and basalt to Mosul, Iraq. Winter rains flood its plain; in summer it is a network of channels. Its volume is double that of the Euphrates, and its current is swift. The Tigris and Euphrates join at Kurna, 90 mi. from the Persian Gulf, to form the Shatt-el Arab, whose navigation to the Persian Gulf is hindered by mud banks and sand bars.

The Tigris is about 1,150 mi. long and is navigable for small craft for over 450 mi. from above Bagdad to its entry into the Shatt-el Arab. Below this point water is lost in its distributaries, and the sinuous course is only navigable for craft drawing two or three ft. of water. During the World War, navigation on the Tigris regained something of its ancient importance: by the end of 1918 nearly 2,000 steamers, collected from all over the world, were plying on the river.

TILBURG, a city in the Dutch province of North Brabant. The city has four Roman Catholic churches, a Reformed church, a synagogue, a magnificent Trappist abbey, an archiepiscopal palace and large manufactures of cloth, woolen goods, cigars, machines and leather. Pop. 1930, 78,651.

TILDEN, SAMUEL JONES (1814-86), lawyer and statesman, was born at New Lebanon, N.Y., Feb.

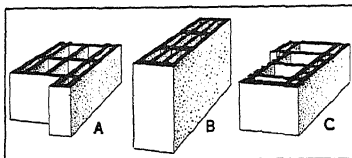
9, 1814. He studied at Yale and at New York University, where he graduated in 1837, being admitted to the bar in 1841. In 1845 he was elected to the New York Assembly, and was made a member of the State constitutional convention and its committee on finances and canals. Returning to the practice of law, his clear and forceful presentation of cases soon won him a preeminent place in his profession. He supported Lincoln during the Civil War, although criticizing some of his actions as unconstitutional. Becoming chairman of the Democratic State Committee in 1866, he commenced his unrelenting war on the notorious "Tweed Ring," and in 1872 entered the State legislature for the purpose of completing his exposure. The smashing of "Boss" Tweed and his associates constituted Tilden's greatest public service. He helped found the New York State Bar Association, and in 1872 secured the impeachment of Judges Barnard and Cardozo. His fame as a reformer led to his election as governor of New York in 1874, and his subsequent exposure of the "canal ring" saved the State millions of dollars.

In 1876 Tilden was the Democratic nominee for President and received a popular plurality over Hayes of more than 250,000 votes. A confused situation ensued, since he had narrowly failed to secure a majority in the electoral vote. Both parties claimed several states, and the Republicans charged the Democrats with widespread intimidation of voters in the South. To determine the results of the election, Congress created an Electoral Commission of 15, of whom 8 were Republicans and 7 were Democrats. The Commission decided on Hayes by one vote, and Tilden ended a tense situation by quietly accepting the Commission's decision. Subsequently, he declined the Democratic nomination for President in 1880 and 1884. Tilden died at Yonkers, N.Y., Aug. 4, 1886, bequeathing most of his fortune for the establishment of a free library.

TILDEN, WILLIAM TATEM, JR. (1893-), American tennis player, was born at Philadelphia, Pa., Feb. 10, 1893. He was graduated from the University of Pennsylvania in 1922. In 1920 he won his first tennis championship, the United States indoor title, and in 1922 won the national clay court championship, which he successfully defended until 1927. He held the national singles championship in 1926-27 and 1929, in addition to championships won in Europe. During 1920-30 Tilden was a member of the American Davis Cup teams. He became a professional in 1930, and in 1931 defeated Karel Kozeluh, professional champion.

TILE, a term here used to include those units of building construction which are made from burned clay but does not include brick or TERRA COTTA. Tile is very extensively used because of adaptability; lightness combined with high compressive and transverse strength; fireproof qualities; resistance to atmospheric conditions; and its sealed hollow cells which provide a very good resistance to the passage of heat. This material in the form of hollow units is used for

load bearing purposes in walls, floors, foundations, and for non-load bearing purposes as split-tile, partition tile and furring tile. Other units of this building material are known as Book tile, Salt Glazed tile and Face tile.

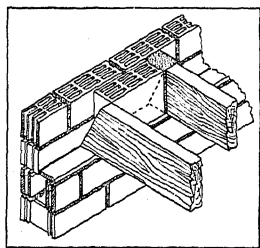


COURTESY NATIONAL FIREPROOFING CORP.

VARIOUS TYPES OF TILE

A, Full jamb for box frame windows;
B, joist filler; C, corner

Tiling is a term used to describe those examples of the ceramic art which are used as a surfacing or finish for floors, walls, and ceilings and in mural decoration on the interior and exterior of buildings.



COURTESY NATIONAL FIREPROOFING CORP.

APPLICATION OF TILE IN BUILDING CONSTRUCTION

Tiles for this purpose are made from different CLAYS, FELDSPAR and FLINTS obtained from domestic banks and quarries or imported from other countries. These tiles can be obtained either glazed or unglazed and in an almost unlimited number of sizes, shapes, colors and textures.

Roofing Tile are of several kinds and shapes. They are usually supported at

their ends and, when used for inclined roofs, have interlocking or lap joints. Clay tiles for roofs include *Spanish*, *Pan*, *Ludowici* and plain tile. Cement tiles of reinforced concrete are similar to those made of clay. Metal tiles of sheet steel, copper, tin and zinc may be obtained in imitation of clay tile. Tiles made of reinforced corrugated glass with lap joints are used on inclined roofs as a substitute for skylights.

Marble roof tiles, of the interlocking concave and convex type found on the Greek temple of Apollo at Bassae, date from the 5th century B.C. The "Spanish" or S-shaped tile and the shingle or flat tile have been common in Latin countries from Roman times until today. During the period of the Roman Empire bronze tiles were used for the roofs of important buildings. Brilliant color and greater ceramic skill mark the roof tiles of the Far East.

During the 13th century common clay tiles were used for the floors of European churches. The predominant colors were red and yellow, the pattern being made by a combination of many pieces. The 16th century Italian majolica tiles, which succeeded these, proved too soft for floor use.

Wall tiles originated in Syria, the Tigris-Euphrates valley and Persia, the art being supreme in Persia by the 15th century. Turkish, Syrian and Persian tiles are among the most perfect wall decorations of

their kind and several potteries in Asia Minor still produce tiles in the traditional colors. The Mohammedan potters of North Africa and Spain developed the type of geometric tile found in the Alhambra, while in Holland after 1600 the town of Delft flooded all of Europe with the highly popular ware of that name. See also BUILDING MATERIALS.

TILE DRAIN consists of pieces of tile made either of clay or concrete laid in a continuous line at such a slope that any water finding its way into it flows by gravity to some lower point. The water enters the drain through the joints between the tile and not through the walls as many suppose. Porous tile are no more efficient than impervious tile and are apt to be soft and easily broken.

Random lines of tile may be laid to drain wet portions of fields, but for land that is uniformly too wet for cultivation a main outlet drain and a system of parallel drains are needed. In clay soil it may be necessary to place drains from 40 to 70 ft. apart and from 2 to 3 ft. deep, while in open soils they may be spaced from 80 to 150 ft. apart and from 3 to 4 ft. deep.

L. A. J.

The tile used for underdrainage systems are normally cylindrical pipes with plain ends, made of concrete or burned clay in lengths of one to four ft., depending upon the diameter. In special cases longer lengths of perforated, corrugated metal pipe are used. Clay drain tile is made in diameters ranging from 4 to 42 ins., and concrete tile, in diameters from 4 ins. to several feet. Drain tile should be true to shape and dimensions, be durable and be strong enough to safely support the external loads coming upon it.

W. J. S.

BIBLIOGRAPHY.—American Standards Association, *Standard Specifications for Drain Tile*.

TILEFISH (*Lopholatilus chamaeleonticeps*), a deep sea fish of the western Atlantic with a curious history. In 1879 numerous tilefish were caught for the first time on a trawl by commercial fishermen. They proved to be excellent food fish and it was planned to develop a fishery for them. Three years later it was reported that more than a million tilefish were floating on the surface of the ocean, dead or dying. A sudden drop in the temperature of the Gulf Stream is considered responsible for the destruction. Several tilefish were caught again in 1892 and now appear in increasing numbers. Beautifully colored, this fish attains a length of about 3 ft. and weighs from 10 to 30 lbs. Its body is compressed and elongate. Another group of tilefishes (*Caulolatilus*) includes the blanquillos which occur on the Pacific coast and are of slight food value.

In 1929 the commercial catch of tilefish in United States waters, taken almost entirely along coasts of New England and the Middle Atlantic States, amounted to 4,621,000 lbs., with a total value of \$219,000.

TILL, the typical deposit of the ice-age over northern Europe and northeastern America, is composed of unstratified drift. This is stiff, compact red or blue

TIGER



COURTESY AMERICAN MUSEUM OF NATURAL HISTORY

TIGERS IN THEIR NATURAL HABITAT

Tigers of southeastern Asia in their native jungle. The male is shown at the left and the female with two cubs at the right.

clay, irregularly mixed with sand, pebbles, and boulders. It is sometimes called boulder clay and also, on account of its refractory nature, "hard pan."

Till-sheet mantles bed-rock to varying depths, in general diminishing land relief by clogging valleys. This leaves elevations almost, if not quite, bare. In level areas along the upper Mississippi, till lies 100 to 200 ft. thick. In northwestern Ohio, it reduces the surface to a till-plain. Here, the finer rock-wastes predominating in the till make good farm land; but the till of New England, which carries numerous boulders from five to 20 ft. in diameter, becomes in places so stony as to defy cultivation. The rock formed of compacted till is known as tillite.

TILLAGE TOOLS, implements used in preparing the ground for planting and in keeping it loose and free from weeds during the growth of the crops. In preparing the ground plows and subsoilers are used for breaking it and drags, harrows, discs and pulverizers are used to level the surface and break up the lumps. For eliminating weeds and keeping the soil loose, hoes, rotary hoes, cultivators, rollers, weeders and the like are used.

TILLAMOOK, an important tribe of the North American Indian Salishan linguistic stock living on Tillamook Bay and the rivers flowing into it in northwestern Oregon. Culturally they appear to have been strayed from the typical Coast Salish and to have been considerably influenced by the northern California tribes.

TILLITE, called also "Glacial Conglomerate," the rock which results from the compacting and cementing, by METAMORPHISM, of the glacial deposits, BOULDER CLAY or TILL. It shows a typically conglomerate structure, since there are rounded or sub-angular boulders in a finer grained matrix. Tillites found in ancient formations indicate that ICE AGES have occurred many times in the geological history of the earth. See also ICE AGES; GLACIATION.

TILLMAN, BENJAMIN RYAN (1847-1918), American legislator, was born in Edgefield Co., S.C., Aug. 11, 1847. He attended Bethany Academy. Illness prevented military service in the Civil War, but he won prominence immediately after hostilities by his leadership of the small farmers against the efforts of plantation-owners to dominate South Carolina. The farming element of the Democratic Party put him forward as candidate for governor, and in a bitter campaign Tillman was elected in 1890, and reelected in 1892. As governor he secured the establishment of a state-supported agricultural college for men and an industrial school for girls. His insistence upon the enforcement of a Dispensary Act which authorized sheriffs to search homes for contraband liquor produced a condition approaching anarchy while the law was enforced. He was elected to the United States Senate in 1894, and three times reelected. He venomously opposed Cleveland's policy, an attitude which he continued against Roosevelt although supporting some of the latter's reform measures. He died at Washington, D.C., July 3, 1918.

TILLY, JOHANN TSERKLAES (1559-1632), Bavarian commander, was born at Castle Tilly, Duchy of Brabant in 1559. Although educated as a Jesuit, he entered the Spanish Army. After serving with distinction in the Austrian Army against the Turks in 1602, he was commissioned a colonel in the imperial troops and two years later artillery-general. In 1610 he entered Bavarian service and 10 years later became commander-in-chief of the forces of Maximilian, head of the Catholic League. His victories in the course of the ensuing THIRTY YEARS' WAR won him military fame throughout Europe. The brutality of his troops to the inhabitants of Magdeburg after its capture and Tilly's complete sack of the city were the greatest outrages in the entire war. Mortally wounded on the banks of the Lech, while fighting the Swedes, he died Apr. 30, 1632, at Ingolstadt, Bavaria.

TILSIT, a German city in East Prussia, on the Memel River about 70 mi. northeast of Königsberg. Tilsit became a city in 1552, was the scene of the TREATY OF TILSIT in 1807, and was occupied by Russian troops in 1914. It manufactures machines, leather goods, soap, tobacco products and honeycakes. It trades in lumber, grain, cheese, leather and horses, aided by the river shipping on the Memel. Pop. 1925, 50,834.

TILSIT, TREATY OF, a double treaty, one part between Napoleon and Alexander I of Russia on June 25, 1807, and the other a treaty practically dictated by Napoleon to Frederick William III of Prussia, on July 7th. The Prussian army had been wiped out at Jena, Oct. 14, 1806 and that of her ally, the Tsar Alexander, at Friedland in June so that Prussia was forced to give up Danzig and to cede all territory west of the Elbe from which Napoleon erected the Kingdom of Westphalia under his brother Jerome. Further territories in the east were detached to go to the French controlled Duchy of Warsaw. Under this treaty Prussia sank to a small power. Napoleon's treatment of Russia, however, was generous and aimed at securing the friendship of Alexander. No territories were taken, the possibility of a future division of Turkey was held before the Tsar, and Alexander was induced to add Russia to Napoleon's continental system of boycott against England. This lasted only until 1811.

TILTING, a modern sport suggested by the knightly jousting of the Middle Ages and popular in Boy Scout and other camps. Two contestants straddle a pole placed across supports a few feet above the ground. Facing each other, about five feet apart, they then try to push each other to the ground with bamboo poles about seven feet long, heavily padded at one end. In canoe tilting, a paddler steers, while the tilter, standing in the bow, tries to overthrow his opponent in another canoe.

See Boy Scouts of America, *Official Handbook*.

TIMAGAMI FOREST RESERVE, in the Province of Ontario, Canada, is located west of Lake Temiskaming and the Upper Montreal River. It has

an area of approximately 6,000 sq. mi. and contains extensive coniferous forests and a network of lakes which abound in lake trout, speckled trout, black bass, pike and pike perch. Lake Timagami in the southern part is almost 30 mi. from north to south and slightly less from east to west. Steamers run twice daily during the summer from Timagami station on the Temiskaming and Northern Ontario railway to the Hudson's Bay Post on Bear Island in the center of the lake.

TIMBER. In legal usage, the word timber covers any trees suitable for building purposes, and it is so used in this article. The word commonly distinguishes large pieces of lumber, such as those used in the framework of buildings or bridges, from boards less than 2 in. thick, planks from 2 to 6 in. thick, laths and shingles.

In spite of the prevalence of stone, brick, cement and steel in buildings, ships and railroad construction, the available timber supply of the United States is rapidly decreasing. So many new uses have been developed that more wood is employed than ever before, and species which a few generations ago were considered worthless are now highly valued.

Trees which yield timber grow in height only from the top and the tips of the branches; they do, however, grow thicker. A transverse section shows three distinct layers: the heartwood at the center, then the sapwood and the bark outside. The growth takes place in the sapwood, which is softer and of more open grain than the heartwood and grows in concentric rings around it. Each ring denotes a year's growth, the light inner portion showing the amount of growth in early spring and a darker portion that of late summer. Extending radially from the center of the tree to the bark are the medullary rays which carry nourishment. As the tree grows older, the proportion of solid heartwood to lighter sapwood becomes larger; trees should therefore not be cut for timber until they contain the greatest proportion of heartwood. Pines and other conifers reach maturity in from 70 to 100 years; most hardwoods between 50 to 100, and oaks between 100 and 150.

The grain of wood is caused by vessels running parallel to the bark, through which moisture is drawn from the roots to the branches. Those in the heartwood are dead, because the protoplasm in the cells has been replaced by air, resins, tannin and gums. Thus the vessels of the sapwood contain more water and for this reason sapwood can more easily be impregnated with preservatives.

In timber that is without knots, the wood fibers generally run parallel with the long axis of the trunk or branch. This gives a straight grain. In some trees, the grain grows in a spiral, twisting around the long axis of the tree. Such trees when sawed will be "cross grain," as will a straight-grained tree sawed in a direction not parallel to its long axis. When such trees as oaks are "quarter-sawed" the log is first sawed into quarters, then sawed diagonally instead of longitudinally, as with ordinary boards. In

other trees, especially those from the tropics, the grain swings from a left spiral to a right spiral, and when logs are cut in the ordinary manner the boards show a double cross or interlocking grain. When quarter-sawed, these trees show a roe-figure, as in mahogany. Ash and occasionally birch trees show a wavy grain which when pronounced is called "curly." Knots change the direction of the fibers in wood and often cause beautiful variations in the grain, called burls.

Before being used for building, timber must be seasoned. This is best done outdoors, though much timber is kiln dried in a tenth the time by stacking it in well-ventilated rooms through which a current of hot air is circulated. Much timber that is to be exposed to moisture or used underground is treated by either painting or impregnation with a preservative. This also protects from dry rot. The first preservatives, creosote and oil of tar, are still used, especially for telephone poles and railroad ties, the hot oils being forced into the wood under high pressure. The kyanizing process employs a solution of mercury bichloride which coagulates the albumen of the wood. Carbolic acid, copper sulphate and zinc chloride are other chemicals used.

Timber comes from two great classes of trees, soft woods come from the conifers, and hard woods from the dicotyledons or broad-leaved trees. The chief soft woods are as follows:

White pine (*Pinus Strobus*), soft and easily worked, with a straight grain and yellowish white color.

Longleaf pine (*Pinus palustris*), a heavy yellow or reddish wood also called yellow pine, the most common lumber on the market.

Spruce (*Picea canadensis*), of which six species are used. Coarser than pine, soft and light; used for all kinds of building construction. Most of the pulpwood made into paper in this country is spruce.

Fir (*Pseudotsuga taxifolia*). The Douglas Fir is the most valuable Pacific Coast timber tree, yielding billions of feet of clear, straight-grained, pine-like lumber.

Cypress (*Taxodium distichum*), a soft, yellowish-brown, exceedingly durable wood much used where exposed to moisture. The beautiful grain makes it suitable for inside trim and paneling.

Redwood (*Sequoia sempervirens*), brilliant rose-purple when freshly cut, purplish-brown when dried. Soft but very durable and much used for shingles, clapboards and interior finish. Grows to an enormous size; resembles the giant sequoia.

Western red cedar (*Thuja plicata*), a reddish, sweet-smelling wood that resists moisture for many years. Used for shingles; also to line moth and vermin proof closets and chests.

Timber from the dicotyledonous trees is used especially for furniture, flooring, cabinet work and interior finish. Among trees thus used are the following:

Black Walnut (*Juglans nigra*), dark brown, close-grain, heavy.

Beech (*Fagus grandifolia*), heavy, close-grained, white.

Maple (*Acer saccharum*), hard, yellowish-white, often beautifully mottled, as in bird's-eye maple.

Sweet or red gum (*Liquidambar Styraciflua*), reddish-brown, heavy, fine-grained; stained to imitate many rare woods. Wood of lower trunk is often beautifully mottled.

Oak. Principal kinds are the white (*Quercus alba*) and the red (*Quercus rubra*), heavy, dense, close-grained. Cut straight grained for flooring and quarter-sawed for furniture. A dozen species of oak are used.

Mahogany (*Swietenia Mahogoni*) is a native of the West Indies and Central America. Spanish mahogany is darker and richer than the Honduras variety. Usually used as veneer.

Teak (*Tectona grandis*), a native of Southern India and Burma. Very durable and strong, it contains an oil which enables it to resist dry rot and moisture.

Hickory (*Carya ovata*) and white ash (*Fraxinus americana*) are used for tool handles, agricultural implements, wheel spokes. Both are white, tough, elastic and straight-grained.

A. R. F.

TIMBERING IN MINING. Timber is the most common support used in mining for keeping the

tervals of about five feet. To prevent the fall of small rocks, lagging, which ordinarily consists of boards, is placed on top of the caps to cover the open spaces between them.

"Shaft Sets," in a rectangular SHAFT, consist of two pieces of timber along the longer shaft wall, called wall-plates and two end-plates placed along the shorter wall, and timbers, known as "dividers," which separate the shaft into compartments. The sets are usually five feet apart and are separated by posts, the intermediate spaces being lined with boards. The timbering of RAISES and WINZES is similar to that used in shafts.

The method of timbering SLOPES depends largely on the stoping method in use. The simplest form is the "stull," a prop placed horizontally, or at an angle, between the walls of the stope. "Square sets" are used in some stoping methods. Each set is composed of a cap, a post and a third piece, known as a girt, meeting so as to form a solid angle of 90°; the ends of the timbers are so cut, or framed, as to form a solid joint. A system of square sets is an open framework of vertical and horizontal members at right angles to each other.

Timber used in mining may be round or square. In small operations, it is cut to dimensions and framed at the working place underground. Where much timber is used, it is more economical to have it cut and framed on surface with the use of saw mills and timber-framing machines.

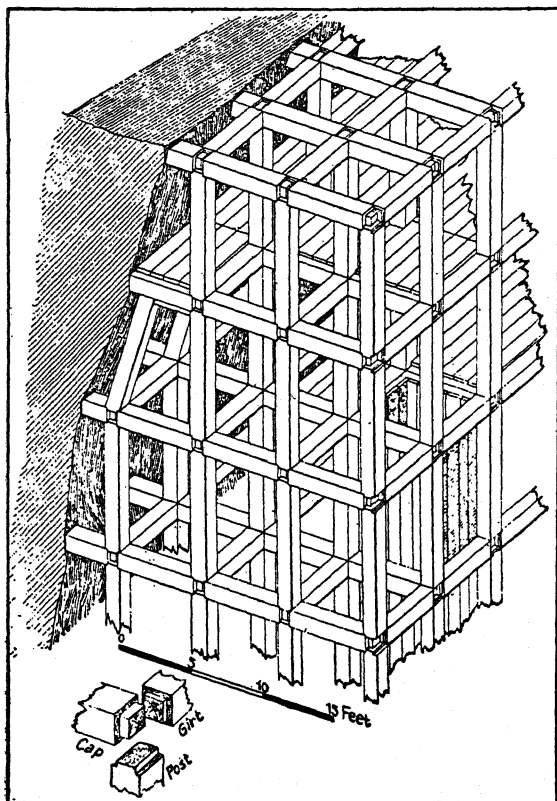
Long-fiber soft woods are best suited for mine timber. Preservatives, such as creosote, zinc chloride or salt solution, are used in treating mine timber. B. L.

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TIMBER-LINE, the level or elevation above which even hardy cone-bearing trees cannot survive on mountain slopes. Here trees grow more stunted as their limit of endurance to cold and winds is approached. At altitudes where the mean annual temperature is two to three degrees below freezing, tree growth ceases, giving place to grass and Alpine flowers which climb to the snowline. The timber-line rises much higher on the sunny and sheltered side of mountains than upon northern or greatly exposed places. It is higher in the tropics than in the temperate zone. In the United States the timber-line ranges from 4,000 ft. on Mt. Washington, N.H., to 12,000 in the Colorado Rockies.

TIMBUKTU, an oasis town of French Sudan, about 9 mi. north of the Niger; occupied by the French in 1893, the town lost much of its importance with the decline of the slave trade. In the first quarter of the 19th century the first European to enter the native territory of Timbuktu destroyed the illusion that it was a city of fabulous wealth. Wars, the slave trade and poor health conditions are responsible for a relatively small population. Pop. 1931, 5,677. See SUDAN.

TIMBY, THEODORE RUGGLES (1819-1909), American inventor, was born in Dover, N.Y., Apr. 5,



FROM G. J. YOUNG, THE WORKING OF UNSTRATIFIED MINERAL DEPOSITS. MCGRAW-HILL

SQUARE SET TIMBERING

workings safe and open for operation. In development workings, such as DRIFTS and CROSSCUTS, the usual construction consists of a horizontal piece, called a cap, supported by two vertical posts, placed at in-

1819. At the age of 22 he designed a revolving battery for artillery and built a steam propelled model which he patented and demonstrated to government authorities. During the Civil War his invention was applied to the construction of the *Monitor*, and he received \$5,000 royalty for each revolving turret so built. The battle between the *Monitor* and *Merrimac* proved the advantage of his device. Later he invented a system of firing guns by electricity and many adaptations of the tower system of defense. Timby died in Brooklyn, N.Y., Nov. 9, 1909.

TIME, astronomically considered, is measured duration counted from some observable epoch. Three different kinds of time are now recognized: sidereal time; apparent, sometimes called true, solar time; and mean solar time. The first is derived from observations of the stars; it is 0 hour, 0 minutes, 0 seconds of each sidereal day at the instant when the VERNAL EQUINOX, a fictitious point whose precise position among the stars is always known, crosses the meridian, and one sidereal day of 24 sidereal hours elapses before the next transit of the vernal equinox. The apparent solar day similarly is the interval between successive transits of the meridian by the sun, but the beginning of the day is taken as midnight. Apparent solar time is the time shown by a sundial. Owing to the motion of the earth around the sun in one year, the sun appears to move eastward among the stars, with the result that each day the sun crosses the meridian a little later as measured by sidereal time. In a year this difference amounts to exactly one day. The apparent solar day, therefore, is longer than the sidereal day.

Since the motion of the earth around the sun is not uniform, being faster in January, that is, than in July, and since moreover the rotation of the earth, which causes all heavenly objects to rise and set, and hence produces the day, takes place on an axis which is not perpendicular to the plane of the orbital motion of the earth, the apparent eastward motion of the sun among the stars is not uniform, and apparent solar time is not uniform. To avoid this difficulty, the real sun has been replaced for the purpose of measuring time by a fictitious sun which has a perfectly uniform eastward motion among the stars. Time measured from this fictitious sun is called mean solar time, and its difference from apparent solar time, called the equation of time, may be as much as 15 minutes. The sidereal day is shorter than the mean solar day by nearly four minutes. Sidereal hours, minutes and seconds are proportionately shorter than mean solar hours, minutes and seconds. As the earth is round and as the sun in its apparent motion crosses one meridian after another, time at one place, local time, is not the same as it is at another.

To avoid the inconvenience of perpetually changing time from place to place, a system of standard time has been adopted. The same time is then used throughout a zone, or a whole country, the time adopted being the local mean solar time corresponding to one particular meridian. Most of the time belts

use standard time that differs from local mean time at Greenwich by a whole number of hours.

W. J. L.

TIME, EFFECTS OF, on materials, vary greatly. CONCRETE PRODUCTS gain strength with age under proper conditions of moisture and warmth, being the only construction material that so acts. All other materials are at their highest quality when manufactured.

By proper manipulation of materials and methods of production, Portland CEMENT concrete may be made to exhibit strengths up to 3,000 pounds per square inch when one day old and from 1,000 to 8,000 pounds per square inch at 28 days. Strengths over 10,000 pounds per square inch have been attained from samples taken from completed structures over a year old.

Many construction materials, including improperly made concrete, deteriorate with age, due to the presence of moisture, air or warmth, or to freezing and thawing, and wetting and drying. Concrete must be made water-tight to exclude moisture during periods of freezing and thawing. Portland cement is, to a limited extent, soluble in water, and the continued percolation of water through concrete may, after a long period of time, cause its disintegration. Concrete made with AGGREGATE which is not sound (*see* ROCK TESTS) will also disintegrate due to freezing and thawing.

Ordinary steel (*see also* CHROMIUM STEELS) will rust, and wood rots in the presence of moisture, air and warmth. ASPHALT and TAR must be kneaded by the action of traffic or they lose their ductility. Some asphalts deteriorate when wet, while tars do not. Vitrified CLAY PRODUCTS when properly made last over long periods of time.

E. E. B.

TIME, EQUATION OF, the difference at any given instant between the mean solar time, which forms the basis of our civil time, and the apparent solar time, which may be determined from a sun dial or by other direct observation of the sun. It may reach a value of as much as 15 minutes.

TIME, STANDARD, a system of reckoning time whereby the clocks within a certain zone are kept together and those in different zones vary by an amount proportional to the longitudinal distance between the zones. At first, time was standardized only in localities, but with the development of railroads and traveling it became necessary to adopt uniform time within a state. The countries in Europe, being comparatively small, usually adopted the time of their capital, as Paris time, throughout the nation. In America that system was not practicable since the time, based on the position of the sun, varies four hours from coast to coast.

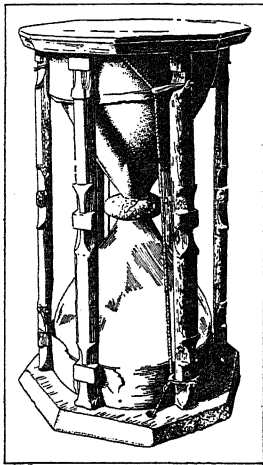
In 1878 Sanford Fleming proposed there be adopted, for the whole earth, 24 standard meridians 15° apart in longitude, starting from Greenwich. These meridians were to be the centers of 24 time zones, each differing from the preceding one by an hour. After some delay this system was adopted by most of the

countries and it is the present international standard of time reckoning. Some countries have divided their zones still further and have half-hour gradations in time. In North America the original system is followed and there are five time belts; viz., the Atlantic, Eastern, Central, Mountain and Pacific. These are respectively, 4, 5, 6, 7 and 8, hours slow on Greenwich time.

In the summer months many localities adopt the daylight savings time schedule which advances the time one hour ahead of standard. This system is particularly popular in industrial centers where the workers profit thereby in having an extra daylight hour in the evening. The daylight savings plan was first put into practice in Germany in 1916 and was soon adopted by Austria, Denmark, England, Holland and Norway. In some countries time is reckoned continuously for 24 hours. This system has obvious advantages.

TIME PAYMENTS AND SALES. See **INSTALLMENT BUYING.**

TIME RECKONING. Among primitive peoples time reckoning is based on certain periodically recurring phenomenon of nature such as the seasons, snow, harvest and the waning of the moon. The



PULPIT TWO-HOUR GLASS

stars are immensely important to primitive peoples and many reckon time and seasons directly from them. The Pleiades is the basis of many systems, and among the South American Indians and the inhabitants of the Marquesas Islands the year and this group of stars have the same name. Succeeding years were commonly designated by some outstanding event as a great flood, war, plague, unusual snowfall or meager crop. The age of an individual was frequently indicated, for example, by his having seen 18 harvests.

The moon is another common basis and the Polynesians and Micronesians have a name for each day which is descriptive of its shape or position. Observance of the solstices and equinoxes entailed a more advanced system for noting definite positions of the sun. Eskimo and certain American Indians kept account of the most northerly and southerly "houses" of the sun and the Inca erected towers which served as markers for the position of the sun and determination of the equinoxes. Time reckoning is usually the duty of the priests who gather their knowledge by painstaking observation and guard it jealously.

TIME RECORDER, a clock-controlled mechanism which makes a printed record of the time at which it is operated. One type is operated by inserting a card and pulling a lever. In another type a radial

arm is moved to a certain position and pushed inward, the record being made on a paper cylinder at a position corresponding to that of the radial arm. Time recorders are widely used for keeping the working time of workmen in industry.

TIME SIGNALS, signals sent out from an astronomical observatory for the local regulation of time-pieces. The United States Naval Observatory in Washington regulates its clock from accurate observations of the stars and sends a daily time signal to Western Union. Western Union regulates its master clock from this signal and sends out time signals at regular intervals to service subscribers. These signals are transmitted by wireless telegraphy, (*see* **RADIO**). By this system, jewelers, railroads, and other precise time industries may have their clocks accurately regulated without making individual astronomical observations. Most of the radio stations broadcast the correct time at frequent intervals so that accurate time is available in the average home. Time signals are especially valuable to ships at sea, since they facilitate accurate determination of **LONGITUDE**. By a system originated in 1913, international time signals based on Greenwich time were sent out from stations located at various parts of the world, but that service was discontinued with the outbreak of the World War.

TIME STUDY is concerned with finding out how long it takes to do work, and then standardizing times and working conditions so that it is possible for the worker to accomplish the work within the time set. This necessitates a study of methods of work. The times are usually taken with a stop watch, and the data thus obtained evaluated and incorporated into standard times for work and, allowances for delays, fatigue, etc.

L. M. G.

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TIMGAD, the ruins of an ancient city in northern Africa, in what is now Algeria. The city was built by Trajan, who called it Thamugas, about 100 A.D. For the next few centuries Timgad vacillated between the Christians and the pagans, until it was at last destroyed by the Arabs in 647. The ruins are reminiscent of Pompeii. The city was laid out as a rectangle with two main streets. Of the capital only the Corinthian columns remain, although the traces of its foundations give evidence of a large building.

TIMISOARA, Hungarian Temesvár, capital of the Rumanian district Timis-Torontal since 1921, formerly of the Banat. Located on a plain on the Bega Canal, it consists of the inner city, surrounded by parks, the factory suburb and three others. There are 13 churches, among them the Roman Catholic and Greek Orthodox cathedrals, four cloisters and four synagogues, large squares, wide streets with fine public and private buildings, advanced schools and a theater. The chief manufactures are cotton, woolen and leather goods, footwear, candles, soap and tobacco. The trade is mainly in grain and lumber. The medieval castle was for a time in the 14th century residence of the Anjou kings of Hungary. Captured by

the Turks in the middle of the 16th century, it became the trade center of Turkish Hungary till 1716, when it was retaken. The Germans are the most numerous nationality and the city is now the German center in the Rumanian Banat. Pop. 1930, 91,866.

TIMON OF ATHENS, a tragedy attributed to SHAKESPEARE; written about 1607. It was borrowed from Plutarch's *Lives* and from Paynter's *Palace of Pleasure*, 1566, and is considered by some critics to be either the rough first draft of a play or the work of another dramatist which Shakespeare merely remodeled. One of the bitterest satires ever written on friendship, this is the drama of a man who spends a vast fortune on his pretended friends only to discover when he himself is poor and needy that his gifts have been forgotten and that his former "friends" no longer recognize him. Driven almost to madness by this disillusionment, Timon resolves to live out his life in a rude cave, like a hermit. As a last jest, he circulates a rumor that he has recovered his wealth and advertises a great banquet; but he serves his fickle friends only bowls of lukewarm water. Finding gold, he flings the precious metal at all who visit him, with imprecations against mankind. And at last the broken-hearted Timon writes his epitaph and dies. Minor characters are Alcibiades, Apemantus and the loyal steward, Flavius.

TIMOR, an island of the Malay Archipelago, the largest and most important of the Lesser Sunda Islands. It extends west of Arafura Sea over a length of some 300 mi. Its breadth averages 60 mi., and it has an area of 12,350 sq. mi., 5,000 of which, in the southwestern part, belong to Holland, and the rest to Portugal. The island is traversed by a series of mountain ranges, the culminating point being Mt. Rameau in the Portuguese section. It reaches a height of 9,600 ft. above sea level. The surface is generally rugged, and agriculture is in a backward stage though small quantities of wheat, potatoes, maize, rice and tobacco are grown and exported. Such tropical fruits as bread-fruit, mango, coconuts and pineapples are grown. Sandalwood, hides, copra, coffee and cacao are the chief exports. Imports include wine, petroleum and textiles. Kupang is the capital of Dutch Timor, and Dilli of the Portuguese territory. The total population is about 800,000, of which 360,000 is in the Dutch and the rest in the Portuguese section.

TIMOR LAUT, a group of 66 islands in the Malay Archipelago, forming part of the Dutch residency of AMBOINA. They lie 250 mi. northeast of Timor island itself and cover a total area of about 2,000 sq. mi. The largest of them is Yamdena, which embraces about one half of the total area. Next in importance are Selaru and Larat. Some of these islands are mere swamps, others are mountainous and well-wooded. The principal crops are maize, mangoes, rice, yams, and sago and coconut palms. Est. pop., 25,000.

TIMOTHY, ST., in Biblical account, associated with St. Paul in the founding of the Macedonian

churches, and traditionally represented as the bishop of Ephesus. He was born in Lystra in Lycaonia, the son of a gentile father and a Jewish mother. Timothy accompanied St. Paul on many important missions, and St. Paul affectionately addressed him as "son." He is said to have been martyred under Domitian and his martyrdom is commemorated on Jan. 24.

TIMOTHY, EPISTLES TO, in the New Testament, are two pastoral letters, which up until recent years have been attributed to the Apostle Paul without question. They are addressed to his disciple and companion, Timothy, and are said to belong to Paul's last years, dating from 66 or 67 A.D. The letters are chiefly questioned by some scholars to-day on the ground that internal evidence shows apparent parallels to Seneca and Epictetus, also that the epistles have references to developed heresies and advanced church organization which belong to a later age. The tradition that the epistles are genuine, however, is very ancient, and their personal details, lists of proper names, and the evident sincerity of their exhortations to zeal, courage and self-discipline usually authenticate them. The Church has found here the foundation and confirmation of many of its doctrines on marriage, the duties of the clergy, the use of wine, and many other matters.

TIMOTHY GRASS (*Phleum pratense*), a valuable meadow and pasture grass, called also herd's grass and cat's-tail, native to Europe and Asia and extensively naturalized through cultivation in North America. It is a strong growing perennial with smooth, erect stems, 2 to 5 ft. high, bearing numerous long, flat leaves and a cylindrical, cat-tail-like flowering spike, 1 to 8 in. long. Timothy grass, commonly planted with red or alsike clover, constitutes an important part of the cultivated hay crop of the eastern United States and adjacent Canada. It is said that the seed was brought from Europe to Maryland about 1720 by Timothy Hanson, whence the name timothy grass by which this valuable hay and forage plant is most commonly known in America.

TIMPANOGOS CAVE, a national monument situated in north central Utah approximately 25 mi. southeast of Salt Lake City. An area of 250 acres within the Wasatch national forest reservation was set aside Oct. 14, 1922 to preserve a huge limestone cavern which is almost 600 ft. in length. Electric lights have been installed in sections of the cave, emphasizing its unusually beautiful stalactite and stalagmite formations. The cave is accessible by automobile from American Fork on the Union Pacific and Denver and Rio Grande Western railroads.

TIMUCUAN, an extinct North American Indian linguistic stock to which belonged a group of related tribes occupying formerly the major part of northern Florida, along the east coast from Cape Canaveral to above the mouth of St. John River, and on the west coast from Tampa Bay to the Ocilla River, to the territory of the Muskogean Apalachee. The stock was named from its most important tribe, the Timucua occupying the middle St. John River. Like

other tribes of this general area, the Timucua were scantily clothed, substituting tattooing for garments. They engaged in agriculture, depending also on shellfish, fish and fruits, and made bread from the coonti root. They lived in stockaded "towns," in circular houses of poles thatched with palmetto leaves, maintained a phratral organization divided into clans with animals' names, and practised cannibalism and human sacrifice as part of their religious rituals. Historically the Timucuan have been known since the landing of Ponce de Leon in 1513, following which time they were successively in contact with later Spanish and French explorers and missionaries who began their labors among them late in the 16th century. The invasions of the English and their Indian allies early in the 18th century rang their death-knell and with the waning Spanish dominion, and the raids of the Creek and Seminole, the Timucuan by the first quarter of the 19th century, when the United States acquired the territory, were practically annihilated.

TIMUR, or **TAMERLANE** (1336-1405), Oriental soldier, was born at Kesh, Turkestan, in 1336, the son of Teregar, chief of the Berlas tribe. He was an assiduous student of the Koran, in youth, but about 1358 he devoted himself entirely to military pursuits. He invaded Khorasan with an army of 1,000 cavalry and subjected Khwarizm and Urganj. After capturing other territories he was proclaimed sovereign, and ascended the throne at Samarkand, his capital. In his reign of 30 years, he consolidated his kingdom, encroached upon adjoining lands, invaded India in 1398, captured Delhi, and made raids upon Egyptian and Turkish cities. A contemplated invasion of China was prevented when Timur fell ill with fever. After establishing his rule from the Irtish and the Volga south to the Persian Gulf, and from the Hellespont to the Ganges, he died in camp at Atrar, in 1405.

TIN, a metallic chemical element, symbol Sn, atomic weight 118.7. This soft white ductile metal has been known since Biblical times. Tin ores are either oxides from alluvial workings, or mixed oxides and sulphides, or sulphides from vein workings. The metal is melted from the ores.

The annual world production is about 180,000 long tons, produced from ores in the Federated Malay States, the Dutch East Indies, and Bolivia, with smaller amounts from China, Siam, Nigeria, Australia, and the unfederated Malay States. It is used as a component of many alloys such as bronze, coinage metal, **GUNMETAL**, Admiralty bronze, white metals such as Babbitt, printing alloys, solders, **PEWTER**, and is a secondary constituent of brasses. Its widest industrial use is in the manufacture of tin plate, for tin containers. Tin can be rolled into very thin sheets, termed foil, or formed into articles such as collapsible tubes. Tin is electroplated on other metals to give decorative and protective coatings. When coated on other metals, usually by hot dipping, it finds wide employment in connection with the handling of MILK and food products in manufacturing plants. See also **TIN AND TERNE PLATE**.

Alloys of Tin. Tin alloys with almost every known metal; binary alloys of tin with aluminum, antimony, arsenic, barium, bismuth, cadmium, calcium, cerium, chromium, copper, gold, indium, iron, lead, lithium, magnesium, manganese, mercury, phosphorus, platinum, potassium, silver, sodium, strontium, tellurium, thallium, zinc, and zirconium are known. In addition, a very large number of ternary alloys (containing three metals) have been studied. The alloys of industrial importance in which tin is a major constituent are the **BRONZES**, essentially copper-tin alloys, used for hardware, statuary, marine work, bells, coinage, and as engineering alloys; the white metals employed for bearings and anti-friction surfaces, ranging from those containing small amounts of antimony and copper added to tin, through the lead-tin alloys such as the babbitts (*see* **BABBITT METAL**), and the white metal alloys used in linotype machines and printing presses, containing 5-20% tin and 15-30% antimony, the balance lead; the solders, generally tin-lead alloys, employed in the sheet metal and plumbing trades and the sheet manufacturing industries; and pewter, originally an alloy of 80% tin and 20% lead, but quite variable in composition, depending upon the particular manufacturer, to fine pewter containing 81% tin, 19% copper, and common pewter formerly containing 82% tin and 18% antimony.

The history of tin and its use in industry, its application to the arts, shows that it has been notable for its most profound effect on the physical properties of other metals. Probably one of the earliest observations in this connection was that tin would harden copper. The modifying influence of tin on copper and lead has constituted one of the most useful if not the most important of all the properties possessed by the metal.

Until the last decade, workers in metal were generally content to add one metal to the other. Alloy making was largely a matter of their own past experience and the practices of others. Scientific research work, of the type which has resulted in our thermal equilibrium diagrams and our vastly increasing knowledge of metallic alloys, is a product of the present generation. As a result, the very numerous tin alloys have been the subject of much investigation, some for purely scientific purposes, but most of it with industrial application in view.

Depending upon the percentage of tin in a copper-tin alloy, bronzes of different colors are formed, ranging from reddish yellow through yellowish red, pale red, ash gray, dark gray, grayish white, and white in case of those containing as high as 65% tin.

The alloys used in the manufacture of bells in the so-called bell metals contain copper from 74 to 85% and tin from 15 to 26 per cent. Other proportions are used to produce different sounds, and other metals, such as zinc, iron, lead, bismuth, silver, antimony, or manganese, may be added either for cheapness or to produce a special tone. The typical alloy is 80% copper, 20% tin. The sound from **BRASS** bells is of

inferior quality. In some of the white table bells, tin is the dominating component. Some white alloys, usually approximating 67% copper, 33% tin admit of a brilliant polish. These were formerly used for mirrors and hence were called speculum metals.

C. L. M.

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TINAMOU, a family (*Tinamidae*) of remarkable birds somewhat resembling a partridge, but more closely related to the ostriches. They range from southern Mexico to the southernmost parts of South America, some inhabiting open grassy country and others the undergrowth of forests. Tinamous are of compact build, varying in length from 6 to 14 in., with rather long necks, short wings and an inconspicuous tail; their plumage is deep yellowish or brownish or grayish barred above with black. Although extremely fleet of foot, they take to wing but rarely, their flight being quite ungovernable though very swift. The note of the tinamou is a distinct trill or whistle; their food consists chiefly of seeds and berries. In a sparsely lined hole scraped under a bush or clump of grass, tinamous lay 4 to 16 exceedingly curious eggs. These are elliptical in shape with a highly glazed or burnished surface, the color in different species varying from brownish to pinkish-orange, primrose, greenish or pale indigo. The task of incubation falls to the male. Because of its delicate flavor the flesh of the tinamou is highly esteemed for food.

TIN AND TERNE PLATE. Steel sheets in the lighter gauges and smaller sizes are a base for the application of pure Tin and terne (lead-tin alloy) coatings in the production of tin and terne plate. Before delivery to the "tin house" the sheets have usually been formed or treated by hot rolling, shearing, opening, "black" pickling, "black" box annealing, cold rolling, "white" box annealing, "white" pickling and storing in "boshes" containing water slightly acidified with muriatic acid. With the increasing cold reduction of steel, cold rolled strip is being used as a tin plate base, with resultant change in practice prior to tinning.

The wet "black" plate is fed magnetically into zinc chloride flux resting upon the molten tin. It is then conveyed by rolls through the tin at 550-600° F. to the oil side of the tinning pot. This oil pot contains the tinning machine immersed in palm oil or hydrogenated oils at about 475° F. The tinning machine consists essentially of two or more pairs of very accurately ground and adjusted hard steel rolls which carry the plate through the pot and regulate the coating. Roll pressures are adjusted carefully and each roll is wiped by an asbestos brush. When the tinned sheet leaves the exit tinning rolls, it is cooled by an air blast and conveyed to the cleaning system where excess oil is removed first by washing and then by rubbing with soft material such as wheat middlings.

Each sheet of the finished tin or terne plate is in-

spected, after which the requisite sheets are "reckoned" and weighed into packages for shipment. Tin plate is sold upon an area basis. The unit of measure is a base box consisting of 112 sheets, 14 by 20 ins., or 31,360 sq. ins. of any size. A common and representative weight for tin plate is 100 lbs. per base box. The tin coating ranges in weight from about 1.5 lbs. per base box for "coke" plate to several pounds per box for "charcoal" grades. Tin plate consumption has grown rapidly with increase in canning. Terne plate carries a heavier coating of lead-tin alloy and is used largely for roofing.

J. C. W.

TINNEH, or Dene, a name applied to the northern division of the North American Indian Athapaskan linguistic stock. This division comprises three groups, consisting of many distinct tribal groups: the eastern, occupying the area between the Rocky Mountains and the lower Mackenzie River and between the Athabasca and lower Peace rivers, Athabasca Lake and Churchill River, and the tribes forming a distinct culture area known as the Mackenzie area; the northwestern, occupying the interior of Alaska and nearby portions of British Columbia to the Rocky Mountains; and the southwestern group occupying the interior of British Columbia from the upper Yukon to latitude 51° 30', the Rocky Mountains forming the eastern boundary. In this northern area the culture of the Athapaskan-speaking tribes was relatively uniform. They were skilled hunters of the caribou and moose; their houses, utensils and clothing were of skin, and they were organized into small bands with simple social and political organization.

TINTAGEL (*Trevena*), a village of Cornwall, England, situated 207 mi. southwest of London. The ruined castle upon the promontory, so weathered as to seem part of the living rock, is the legendary birthplace of King Arthur, and the site of King Mark's fortress. Other antiquities are a 9th century roodstone; the restored parish church with Norman and Saxon work, and, near it, graves buttressed against the region's violent storms; and an ancient dovecote in the 14th century vicarage grounds. Tintagel, romantically situated on the magnificent Cornish coast, is acquiring popularity as a resort. Pop. 1931, 1,400.

TINTERN ABBEY, a ruined Cistercian abbey of extraordinary beauty, in Monmouthshire, England, 9 mi. below Monmouth on the River Wye. Of the extensive ruins of the abbey, which was founded in 1131 by Walter de Clare, the most important remnant is the abbey church. It is a roofless but otherwise well-preserved edifice, dating from 1270 to 1325, with many exquisite decorations in the style of the period transitional between the Early English and the Decorated. The natural beauty of the countryside about Tintern has been celebrated in Wordsworth's *Lines Composed a Few Miles Above Tintern Abbey*, 1798.

TINTOMETER. See CHROMATOMETER.

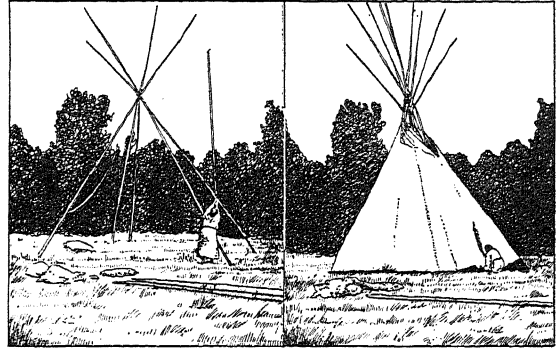
TINTORETTO (c. 1518-94), Venetian painter. Jacopo Robusti, known as Tintoretto, "the little dyer,"

from his father's trade, was born at Venice, probably in 1518. He was practically a self-taught artist, for, after a few days in Titian's studio, he was dismissed without explanation. This remarkable rebuff seemed to inspire the young painter with indefatigable energy. He at once bought casts from the antique, and from Michelangelo. All day he painted; at night he drew from his casts, loudly announcing that he would draw like Michelangelo and color like Titian. No commission was too insignificant for him. Large decorations were fulfilled for the cost of the materials alone. Before he reached forty he was Titian's rival. His masterpiece, *The Miracle of St. Mark*, in the Academy at Venice, was painted when he was 37. Unfortunately many of his mural decorations have disappeared, and most of his easel-pictures have suffered from restorers' zeal. The rapidity of his execution was such that he was nicknamed "Il Furioso." Sebastiano del Piombo said that Tintoretto could paint as much in 2 days as he himself could in 2 years. The unevenness of his work was notorious, and one of his contemporaries, Annibale Carracci, remarked that "if Tintoretto was sometimes equal to Titian, he was often inferior to Tintoretto." He was probably the most prolific of the great artists, working usually on a gigantic scale. As a portrait painter he was erratic, his work varying according to his interest in his sitter. His daughter Marietta, who died in 1590, before she was 30, was an excellent portrait painter. Tintoretto died at Venice, May 31, 1594.

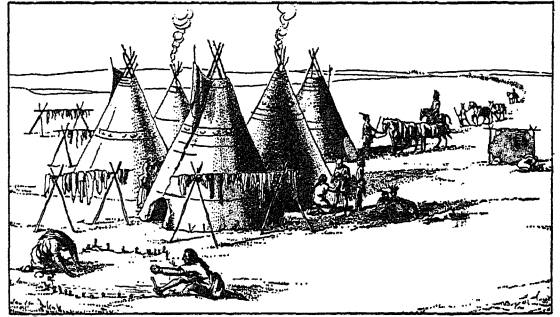
TIONONTATI, a North American Indian tribe of the Iroquois linguistic stock. They formerly occupied the mountains south of Nottawasaga Bay in Grey and Simcoe counties, Ontario, Canada. They were discovered by the French in 1616 who found them cultivating tobacco and in consequence called them the Tobacco Nation. A Jesuit mission was established among them in 1640. Following their destruction by the Iroquois in 1649, the Tionontati were joined by Huron refugees, bringing on themselves another attack by the Iroquois, and the consequent flight of the Tionontati to Lake Superior, then to the Potawatomi at Green Bay, Wis., and later to Mackinaw near Lake Michigan. The two groups have been known in modern times as Wyandot, although the Tionontati retained their name and their hereditary chieftainships within this more modern grouping.

TIPI (or Tepee), a Dakota Indian word meaning house, which has come to be generally applied to the conical skin-covered tent used by the nomadic Indians of the Great Plains of Central North America, a portable structure ideally adapted to quick raising and dismantling. Its size and the details of construction varied somewhat, some tribes of the Plains area setting up a foundation of three poles and others of four poles. Around these foundation poles were laid a sufficient number of additional poles, from 12 to 30, to form a conical framework and support the weight of the skin cover. In aboriginal times the skin cover was of buffalo or sometimes of elkskin

and was, in form, roughly a half circle. The tipi cover was often decorated with heraldic designs or designs emblematic of the martial prowess of the owner. Setting up the tipi, as well as the initial



SETTING UP A CROW TIPI



A CROW LODGE

preparation of the skin cover, the skin dressing and sewing, were always the work of the women. Other conical structures with bark or mat covers instead of



FROM MAXIMILIAN VON WIED-NEUWIED'S ATLAS

INTERIOR OF A HUT OF THE MANDAN INDIANS
After a drawing by Karl Bodmer

skin were used by many North American Indian tribes. In fact, some type of conical shelter is found over the whole continent from the borders of the Eskimo area in the north to the Rio Grande in the

south; the Rocky Mountains form the western boundary of its distribution while to the east conical structures were used all over the country from New Brunswick westward to north of the Great Lakes and thence west of the Mississippi River.

TIPLITZ-SCHONAU. See TEPLICE-ŠANOV.

TIPPECANOE AND TYLER, TOO, a campaign slogan of the Whig party in the national election of 1840. Gen. WILLIAM HENRY HARRISON, the party's candidate for president, had defeated an Indian force under the leadership of Tecumseh at the Battle of Tippecanoe, Nov. 7, 1811, thereby gaining national popularity; the Whig candidate for vice-president was JOHN TYLER. The phrase "Tippecanoe and Tyler, too" was the refrain of the most popular campaign song.

TIPPERARY, an island county of the Irish Free State in the province of Munster; area 1,659 sq. mi. The highest elevation, Galtymore, is 3,000 ft. above the sea. The level country forms part of the great central plain of Ireland, and includes some branches of the Bog of Allen. It is drained largely by the River Suir. The soil is extremely fertile, producing fine crops of oats, potatoes and wheat. Cattle-raising and dairying are the chief occupations. Mineral production comprises slates of good quality, and some coal, lead, zinc and copper are mined. The chief towns are Tipperary, Nenagh, Cashel, Clonmel and Carrichon-Suir.

Tipperary, the county town, is situated on the River Arra, 110 mi. southwest of Dublin, in a district called Golden Vale. There is a good trade in dairy products, especially butter. Pop. 1926, 141,015.

TIRABOSCHI, GIROLAMO (1731-94), Italian historian, was born at Bergamo, Dec. 28, 1731. Educated by the Jesuits, he engaged in teaching until in 1770 he was called by the Duke of Modena to take charge of the library at Modena. Here he composed his monumental *History of Italian Literature*, 13 vols., 1772-81, an exhaustive survey of Italian art, science and literature from the earliest times to the eighteenth century, which is one of the monuments of Italian literature. Tiraboschi died at Modena, June 3, 1794.

TIRANA, capital of the kingdom of ALBANIA, situated on the Kroya plain about 20 mi. north of Durazzo. It is encircled by hills covered with forests. Tirana, although dating from the 17th century, was of but local importance until after the World War when Essad Pasha, whose domain it had been in Turkish days, made it the capital of the Albanian Republic. Now as the capital of King Zog it is a thriving center, with electrification, new buildings and numerous improvements. The finest building in the city is the legation of the United States, erected by the United States government in 1928. There also an American Red Cross technical school and an orphanage. Tirana still remains unconnected by rail with Durazzo or with any other Albanian town, although a regular air passenger service is maintained with Koriza. The market place of Tirana presents

a striking sight with European ministers and legation attachés mingling with the Ghegs of the hills. Pop. 1930, 30,806.

TIRE INDUSTRY. The introduction of pneumatic tires for bicycles gave rise to the tire industry about 1890. The solid rubber tires had been in use to some extent in more or less of an experimental way for about 50 years prior to 1890, but the manufacturing had been on such a small scale that it amounted to little more than another rubber product.

With the growth in popularity of the bicycle over the next ten years, the demand for pneumatic tires developed the industry from the embryonic stage to a going industry of its own. This young industry had another tremendous impetus given it by the coming of the automobile the latter part of the '90s. Naturally enough, this new industry followed quite closely the growth of the automobile industry, starting with about 250,000 tires in 1900 and reaching 2,500,000 by 1910. But just as the automobile industry experienced its greatest growth from 1910 on, so also did the tire industry so that in the next 20 years it reached the production of 75,000,000 tires a year. This enormous growth is shown on Chart 1.

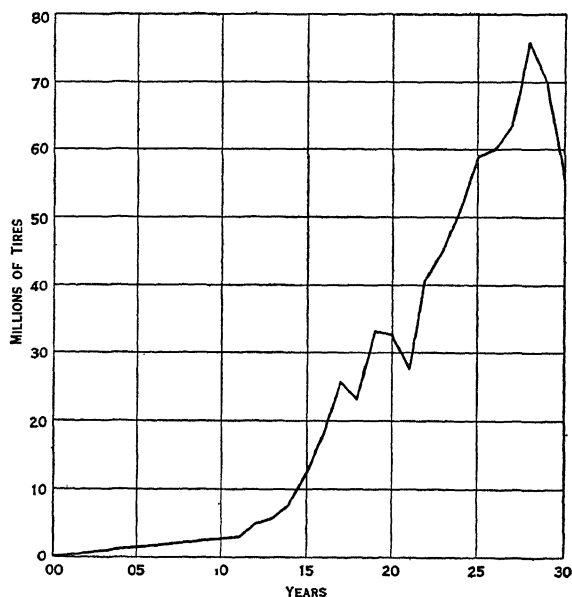


CHART 1. GROWTH OF TIRE INDUSTRY FROM 1900 TO 1930

The existence of the tire industry is contingent upon the Goodyear patent of 1844 for the vulcanizing of rubber which made its use practical for many purposes. Undoubtedly someone else would have made the same discovery at some later date, but had it not been discovered, neither the bicycle nor the automobile industries would have developed much beyond the experimental stages because the tremendous development of both was made possible only by the pneumatic tire.

It was not until 1921 in the Census of Manufacturers that the tire manufacturing was separated from

the rest of the rubber industry at which time the value of tires produced had reached a half a billion dollars a year. During the next ten years the tire industry reached tremendous volume, the peak coming in 1925 and amounting to 925 millions. Since then, with the decline in the average price of tires, the annual value decreased to 777 million in 1929.

Chart 2, showing the annual imports of crude rubber into the United States from 1870, probably indicates better the tremendous effect the growth of the automobile industry has had upon the rubber industry than does the production of tires alone. It shows the very rapid increase in crude rubber im-

rubber, the rubber imports would very probably have followed the curve from 1870-1911.

The future growth of the tire industry is assured, even though the motor industry has reached its period of stability in which its annual growth is going to be at a decreasing rate, by the fact that there are millions of cars in use that must have tires replaced and new cars must be produced to replace old ones. There also should be a small annual increase in the number of cars used.

R. B. P.

TIRNOVO or **TRNOVO**, a city of Bulgaria, capital of the district of the same name, situated on the banks of the Yantra River, a tributary of the Danube,

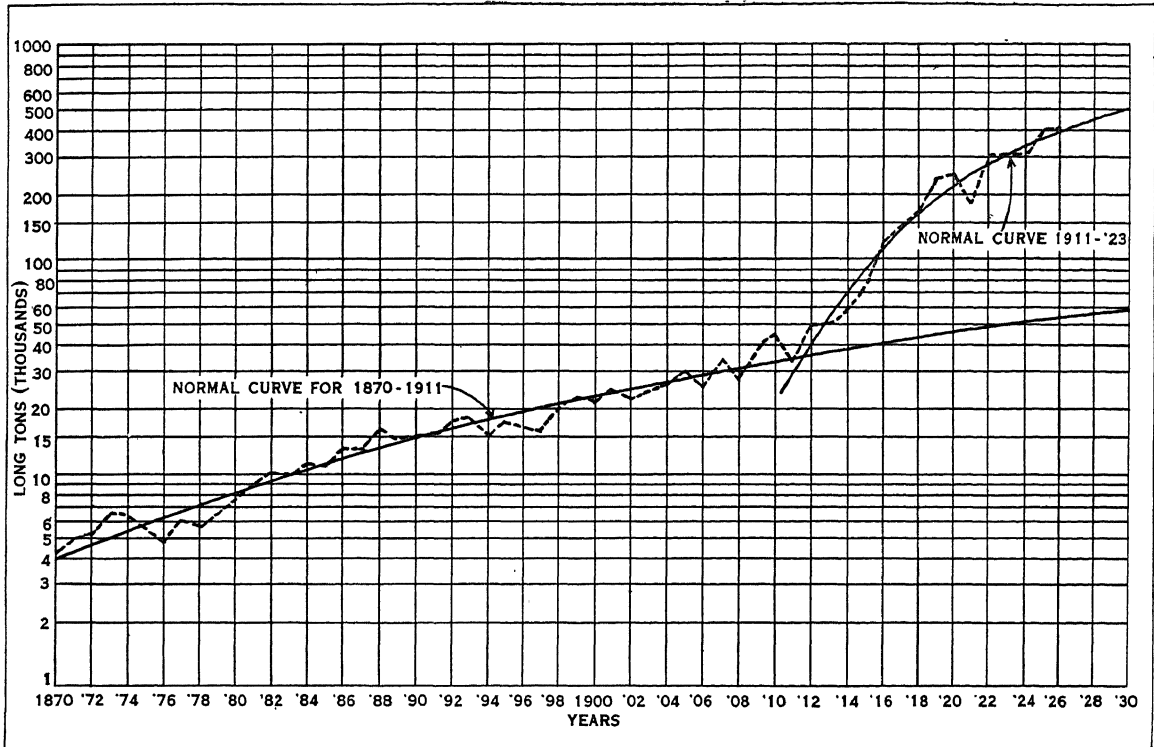


CHART 2. ANNUAL IMPORTS OF CRUDE RUBBER INTO THE UNITED STATES

ports, starting in 1910 and brought about by the enormous growth of a motor industry with its demand for tires. Prior to 1910 the principal use for rubber had been for mechanical goods. If there had been no automobile to create the larger demand for crude

and on the railroad from Sofia to Varna. The houses of the city climb in terraces up a roof-like slope above the river, which encircles the historic promontories of Trapezitza and Tsarevitza, the former isolated from the inhabited town and the latter connected by a causeway. To-day a center of considerable commercial importance, it is as a historical town that Tirnovo holds the greatest interest. In the middle ages the town became the capital of Bulgaria. For two centuries thereafter until its capture late in the 14th century, Tirnovo thrived as the resplendent capital. In 1908 Bulgaria was made an independent kingdom at Tirnovo. Pop. 1931, 15,430.

TIROL. See **TYROL.**

TIRPITZ, ALFRED P. FRIEDRICH VON (1849-1930), German admiral, was born at Kustrin, Mar. 19, 1849. He entered the Prussian Navy in 1865, was promoted post-captain in 1888, rear-ad-

RUBBER TIRE INDUSTRY, U.S., 1929

Division	No. Establishments	Employees and Wage Earners	Salaries and Wages \$	Value of Products \$
United States . . .	91	96,244	158,179,577	770,176,890
LEADING STATES:				
Ohio	32	63,207	107,663,001	503,197,194
California	7	6,343	10,502,498	56,287,838
Wisconsin	5	4,556	6,417,305	41,244,345
Pennsylvania	6	1,862	2,495,843	13,491,443
New Jersey	6	2,441	3,638,046	11,386,447

miral in 1895, and in 1911 became Admiral of the Fleet. During the 10 years preceding the World War, Tirpitz led an unflagging campaign for a larger navy with the result that at the outbreak of hostilities he had made the German Navy the 2nd in the world. The submarine blockade of the British Isles, 1915-16, is credited to Tirpitz. He resigned as Lord High Admiral after the loss of the *Lusitania* in 1916. He died at Ebenhausen, Mar. 6, 1930.

TIRSO DAM, located on the Tirso River, island of Sardinia, Italy, is a hollow dam of multiple arch type having a maximum height of 221 feet above foundation level and 191 feet above the bed of the river. The reinforced concrete arches are supported on cut-stone masonry buttresses 216 feet wide at the base and spaced 49 feet apart. The buttresses have a maximum thickness of 33 feet and the arches a maximum thickness of five and one-half feet. The dam forms part of a power and irrigation project and creates a reservoir of 14 billion cubic feet capacity.

TISCHENDORF, LOBEGOTT F. K. VON (1815-74), German biblical student, was born at Lengenfeld, Saxony, Jan. 18, 1815. From 1845 until his death, he was a professor at Leipzig University, where he had received his education. His biblical research took him on long journeys throughout Europe and the near East. In 1844 he made his most noteworthy discovery in the Monastery of St. Catherine on Mount Sinai, bringing back with him the famous *Codex Sinaiticus*, an early Greek version of the Old and New Testaments, now in the Vatican. His various codices on the Old and New Testaments and his critical edition of the New Testament published in 1872 have made all biblical scholars his debtors. He died at Leipzig, Dec. 7, 1874.

TISSUES, a term generally employed to designate the groups of organized materials that make up the structure of living things. The tissue groups correspond to general but definite physiologic requirements of the organism. In all vertebrates with which man shares a common plan of organization, five tissue groups are commonly recognized. These are epithelium, connective and supporting tissue, muscular tissue, nervous tissue and blood and lymph.

Epithelium (Epithelial Tissue) is a cellular tissue with the cells but little modified. It covers free surfaces of the body and the type of epithelium encountered on any surface is an expression of the functional requirements for that surface. The most obvious epithelium is the epidermis of the skin which is highly protective. Nails, hoofs and hair are special epidermal structures. On other surfaces the epithelium may be absorptive as in the intestine, secretory as in glands, ciliated as in the respiratory passageways and sensory as in the eye, ear or nose. In thickness epithelium grades from many layered, e.g., epidermis, to a single layer of thin cells, endothelium, in heart blood and lymph vessels. It is the primitive tissue and the most universal.

Connective and supporting tissues are primarily

skeletal in function, forming the hard (bones, cartilages) and soft skeleton (loose and dense connective tissue, tendons, ligaments). In these tissues intercellular substance gives the tissue its physiological value. The cells, while essential, are often insignificant. Nevertheless, particularly in the loose connective tissues, certain cells are of marked importance as defense cells, i.e., phagocytes and macrophages, in the destruction of invading microorganisms. In special places the relation of the connective tissue to blood-cell formation is very intimate. In healing wounds a special connective tissue, called scar tissue, is formed.

The muscular and nervous tissues are highly specialized protoplasmic tissues, muscular tissue for contraction, nervous tissue for conduction. Three forms of muscle exist: plain or smooth muscle, cardiac and skeletal muscle. In cardiac and skeletal muscle the contractile substance is cross-striated. The cross-striations are expressions of a complexity linked with the rapidity of the contraction process. Wing muscles of insects and of humming birds contract very rapidly and have highly developed cross-striations.

In nervous tissue the cells are so modified in form through the presence of processes that they are usually distinguished as neurones. One process, the axon, is very long and usually becomes the central core of a nerve fiber. The neurones are links in chains of great complexity.

Blood and lymph, a circulating tissue, is the servant of the body metabolism. In the fluid, plasma, float the corpuscles of three kinds: the red corpuscles, oxygen carriers by virtue of their content of haemoglobin; the white corpuscles or leucocytes; and the blood plates or thrombocytes.

Among invertebrates the body tissues are often markedly different. Thus, the external skeleton of insects is an epithelial product and the muscle is only of the skeletal variety. In mollusks plain muscle alone may be present.

B. F. K.

TISZA RIVER. See THEISS.

TISZA, COUNT ISTVÁN (STEPHEN), (1861-1918), Hungarian statesman, was born, April 22, 1861, the youngest son of Kálmán Tisza who headed the Hungarian ministry from 1875-90. István studied at Berlin, Heidelberg, and Budapest, specializing in agrarian economy. He first entered parliament in 1886, and in 1897 published an able work entitled *Magyar agrárpolitika*. In Oct., 1903, he became premier and minister of the interior, posts which he later re-occupied on several occasions. His political career was extraordinarily stormy and was accompanied by numerous duels and attempts on his life. His great physical courage tended to make him quite popular. Politically his greatest opponents were the Counts Andrassy and Karolyi.

Tisza was a staunch Magyar patriot and a loyal supporter and adviser of Francis Joseph. He favored a strong army and close adherence to the terms of the alliance with Germany. He watched with misgivings the growing strength and self-assurance of Serbia and was worried over the declining power of

Bulgaria and Turkey. Although sometimes regarded as one of the prime authors of the Austrian move against Serbia after the assassination of Archduke Francis Ferdinand in 1914, Tisza did not favor Berchtold's policy of framing an unacceptable ultimatum or of an immediate attack upon the Balkan kingdom.

The young Emperor-King Charles (1916-1918) was under the influence of Tisza's political enemies, and in June, 1917 the premier was dismissed, ostensibly for his refusal to extend universal suffrage to the soldiers and for his opposition to the Socialists. He had also proved himself antagonistic to German schemes of aggrandizement and was heartily in favor of ending the war quickly on a basis of moderate peace terms. For a time after his dismissal he headed the Opposition, but then soon went to the front to command with distinction a regiment in the Bukovina and in Italy. By Oct., 1918, the Austro-Hungarian cause appeared to him to be hopelessly lost, and on the seventeenth he returned to Budapest, hoping to unite the various parties into one strong group for the sake of securing more favorable peace terms. His real motives and intentions misunderstood by the people, however, he was killed by a group of "defeatist" soldiers on Oct. 31, the eve of the Karolyi republican revolution. A German edition of Tisza's letters was prepared in 1928 by O. von Wertheimer.

TITANIA, queen of the fairies in Shakespeare's *MIDSUMMER NIGHT'S DREAM*. Bewitched by her husband, **OBERON**, for a time she falls in love with **BOTTOM**, a lout whose head Puck had changed into that of an ass.

TITANITE. See **SPHENE**.

TITANIUM, one of the metallic elements of the fourth group of the periodic system, symbol Ti. Its atomic weight is 47.9, density 4.5 and melting point approximately 1825° C. The metal possesses the color of polished steel and, although hard when cold, can be forged and drawn at red heat. Its most distinguishing property is its ability to combine readily with nitrogen, being the only element that burns in nitrogen. In its commonly occurring compounds with oxygen and the halogens it is tetravalent. Its oxide TiO_2 possesses remarkable chemical stability, high refractive index and hiding power, which makes it admirably suited as a white pigment or paint base.

Large tonnages of ferro-titanium, containing either 15% titanium together with about 7.5% carbon, or 25% titanium with about 7% aluminum, are marketed for consumption in the steel industry. The carbon-containing product is manufactured in the electric furnace and the carbon-free alloy is produced by aluminothermic reduction. The greatest production of titanium, however, is in the form of oxide for the pigment trade. For its manufacture ilmenite, a ferrous titanate mineral, is digested with sulphuric acid, followed by extraction with water and precipitation of the titanium dioxide out of the sulphate solution by hydrolysis at elevated temperature, followed by filtration and calcination of the precipitate.

Ferro-titanium is added to molten steel as a so-

called scavenger for the purpose of deoxidation. It is used especially in the manufacture of sheet bars and forging steels.

Titanium dioxide is used as the basic pigment for white paints. It is also used in lacquers, synthetic plastics of the Bakelite and other types, linoleum, rubber, wall papers and coated fabrics, glass, ceramics, paper products, and in coated and vitrified enamel ware. Titanium sulphate and chloride are used in dyeing, titanium potassium oxalate in finishing and dyeing fine leathers, and titanium tetrachloride in the production of smoke screens. B. D. S.

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TITANS, in Greek mythology, were the children of **URANUS**, or Heaven, and **Ge**, or Earth. The Titans were thus an elder generation of gods. The six male Titans were **OCEANUS**, **COCUS**, **CRUIUS**, **HYPERION**, **IAPETUS** and **CRONUS**. The females were **THEA**, **RHEA**, **THEMUS**, **MINEMOSYNE**, **PHOEBE**, and **TETHYS**. As the earliest supreme deity, **URANUS** condemned many of



BATTLE OF THE TITANS

From a 4th century vase in the Louvre, Paris

his unruly children to dwell by the River Tartarus. The Titans, thus moved to rebellion, deposed **URANUS** and placed **CRONUS** on the throne. (See **BRIAREUS**; **CYCLOPS**.) **CRONUS** had been warned that he would be slain by one of his children. As his offspring were born, therefore, he swallowed them, but **RHEA** saved her babe by handing to the father a stone wrapped in cloth. This infant was **ZEUS**, who in due course made war on the Titans, dispossessing **CRONUS** and hurling the defeated deities into a cave below Tartarus.

TITCHENER, EDWARD BRADFORD (1867-1927), American psychologist, was born at Chichester, England, Jan. 11, 1867. He was educated at Brasenose College, Oxford, where he was senior scholar in classics and philosophy. He received his Ph.D. degree from the University of Leipzig in 1892, and in the same year became assistant professor of psychology at Cornell University. After 1910 he was Sage professor of psychology. One of the leading psychologists, Titchener was the author of many valuable books, among which are *Experimental Psychology*, 1901-05,

Experimental Psychology of the Thought-Processes, 1909, and *Text-book of Psychology*, 1910. He died at Ithaca, N.Y., Aug. 3, 1927.

TITHES are taxes, especially common in Catholic countries, ordinarily taken for the support of the Church. They are of ancient origin and were often "paid in kind" as a tenth part, or tithe, of the proceeds of the land and personal endeavor.

TITHONUS, in Greek mythology, son of LAOMEDON and brother of PRIAM. Eos, loving him, asked Zeus to grant him immortality, but forgot to include eternal youth. The wish was obtained; but Tithonus grew into such an ugly old man that Eos changed him into a grasshopper. Memnon was their son.

TITIAN (c. 1477-1576), one of the greatest Italian painters, was born at Pieve di Cadore in the Carnic Alps, probably in 1477. His real name was Tiziano Vecellio. There is some doubt about the date of his birth but it is known that he came of an honorable family of Venetian origin. At the age of 10, he went to Venice with an uncle who placed him with the celebrated master, Giovanni Bellini. Here, among the pupils, Titian met Giorgione, a youth of wonderful genius, whose work made a lasting impression on the other boy. Together they painted frescoes for the Fondaco de' Tedeschi in Venice, and in 1511, the year of Giorgione's death, Titian went alone to Padua where his frescoes are still to be seen. He finished the uncompleted works of Giovanni Bellini after the latter's death, and was given a yearly salary by the Venetian Government to paint the portrait of every Doge who held office in his time. Twice he went to Bologna, between 1530 and 1532, to paint the portrait of the Emperor Charles V, who later created Titian a Count Palatine of the Empire and a Knight of the Order of Saint Iago. The great equestrian portrait was not done until 1548. Pope Paul III, having sat to the artist for two portraits, offered him an official position in Rome, but this was declined. As an artist Titian had not the amazing precocity of Giorgione. He developed gradually and was over 30 before he came into full possession of his powers. His style grew broader; the pigment was applied in a paste that glows with color and light. No one ever surpassed him in rendering pearly flesh tones, and indeed it is evident that what painters had been struggling to achieve since the dawn of the Renaissance came to full flower in Titian's work. His portraits had a grandeur, his religious subjects had an appeal that was deeply human and his mythological compositions were not mere slavish imitations of Greek forms. Although Titian lived to an advanced age, his work never declined as in the case of lesser men. The *Pieta*, painted when he was well over 90, shows immense vigor and enthusiasm. In 1576 a plague ravaged Venice and the great artist was one of its victims, his death occurring there on Aug. 27.

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TITICACA, LAKE, the largest lake in South America, situated on the boundary of Peru and Bolivia, but belonging almost more to Bolivia than to Peru. It forms an irregular oval, disposed in the same direction from southeast to northwest as all the great Peruvian ranges, and divided into two very unequal secondary basins by the two peninsulas of Copacabana and Tiquina. It has an extreme length of 138 mi., with a mean breadth of 45 mi., a depth of 900 ft., and a total area of 3,300 sq. mi. Its present altitude, which slightly varies with the seasons, ranges from about 12,500 to 12,600 ft. above the sea. It formerly stood much higher, and is said to have then drained to the Amazon; but of this there is no evidence. It is a freshwater body and discharges through the Desaguadero emissary, 160 mi. long, to the swampy and saline Lake Poopo (*Aullagas*) which has no outlet and whose waters evidently disappear by evaporation and by seepage into the great depth of underlying gravels. Owing to its high altitude Titicaca presents a dreary aspect, its treeless shores fringed with a scant and stunted vegetation and its shelving margin overgrown with tall rushes.

The region around Titicaca was one of the seats of early Indian civilization. The Aymaras were the first tribes met by the Incas when they penetrated into the north side of the lake country.

There is a brisk movement of reed boats (*balsas*) and steamships which engage in domestic and international trade. A primitive but important means of transport on the lake is the *balsa*; the boat is made of the tall reeds that grow about the margins of the lake tightly bound together with marsh-grass ropes, and is propelled by reed sails; unless dried out frequently the *balsa* becomes waterlogged and sinks. Two steamers of 600 to 1,000 tons, respectively, navigate the lake. All parts for these steamers were made in Britain, taken to South America, carried over the Andes and put together on the margin of the lake. The materials for the first steamer had to be transported by mules, for no railway then reached the lake.

TITLARK (*Anthus spinoletta*), called also pipit, a small songbird of the wagtail family found practically throughout the Northern Hemisphere, the American pipit (*A. s. rubescens*) breeding in the Rocky mountains and the subarctic and wintering in the Gulf states and Central America. It is about 6½ in. long, streaked olive-brown above and buff spotted with brown below. Frequenting meadows, pastures and especially open tracts near seacoasts, it runs about gracefully on the ground, often jerking its tail, in search of seeds and insects, or, if on the shore, shellfish, crustaceans and small aquatic insects. The nest, in which are laid four to six grayish speckled eggs, is made of grasses and placed on the ground. Like the lark, this small bird utters its clear bell-like but somewhat plaintive song while on the wing.

TITLE GUARANTEE COMPANIES, companies which insure people dealing with real estate titles against loss due to bad titles or to encumbrances

against a property. These companies usually keep their own real estate records for the territory in which they operate, and they employ experienced real estate lawyers to make the necessary examinations of the titles before granting guarantees. Title guarantee companies have achieved commercial success only in the United States. The first one was founded in Philadelphia in 1876.

TITLE INSURANCE creates an obligation whereby an insurer agrees, for a premium paid by the insured, usually a purchaser or mortgagee, to protect the latter against losses arising from defects in or the marketability of title to specified land. The policy is an indemnity contract; the insured must have an interest in the property.

In early days, lawyers searched the records and gave opinions on titles. Later, a history or abstract of title was prepared from the records and the lawyers examined this and prepared opinions. In 1876 the first title insurance policy was issued in Philadelphia.

The defects insured against may or may not, appear "of record." Defects which do not appear may raise an issue, for example, as to the genuineness of the instruments recorded, or as to their proper delivery, or as to the rights of children born after the making of a will. The liability of the insurer is not ordinarily limited to the defects which appear of record.

A. E. E.

TITLES OF HONOR, designations conferred upon or borne by certain persons as marks of distinction and dignity. Titles of honor may be classified as those belonging to sovereigns and nobles and those of particular official significance, and they may be further classified as true titles of honor and titles of courtesy. Greater sovereign titles include Emperor, King, Sultan and Shah. Czar and kaiser correspond to emperor. Lesser sovereign titles are Grand Duke, Duke and Prince, and the corresponding Eastern titles, Bey, Khan and Khedive. Titles of nobility include those of the greater nobility comprising Prince, Duke, Marquess, Count (Earl in England), Viscount and Baron; those of lesser nobility comprising Baronet and Knight. Chevalier and Ritter are French and German titles equivalent to Knight. Official titles of honor are largely those of ecclesiastical, military or governmental nature, as archbishop, general, governor and the like. Titles of courtesy are those given the sons of nobles in accordance with custom rather than by law. The eldest son usually receives a title second to that of his father. The youngest sons of dukes and marquesses bear the title Lord and those of earls, viscounts and barons, Honorable. The daughters of dukes, marquesses and earls bear the title Lady and those of viscounts and barons, Honorable. *See also* ADDRESS, FORMS OF; separate articles on the above designations.

TITMOUSE, the common name for a family (*Paridae*) of small passerine birds allied to the nuthatches. There are nearly 250 species of wide distribution. All are less than 7 in. long with soft, fluffy, chiefly gray, black and white plumage, short stout bills and

sometimes headcrests. They are very active and industrious, frequenting woodlands, thickets and undergrowth and feeding largely upon insects. Some nest in holes excavated in trees while others construct large, pendulous, purselike nests. Titmice are poor singers. Well-known native North American species are the tufted titmouse (*Baeolophus bicolor*), found chiefly in the eastern states, and the CHICKADEE. *See also* BUSH-TIT.

TITUS, a coworker with St. Paul in missionary work in Greece and Asia Minor, whose name is associated with the Pauline *Epistle to Titus*. He was probably a native of Asia Minor. According to tradition he died at an advanced age while serving as bishop of Crete. His name, however, is most intimately connected with the Church at Corinth.

TITUS, EPISTLE TO, in the New Testament, is generally accepted as a letter from the Apostle Paul to his convert and companion, Titus, a Greek by birth, who is mentioned in 11 other places in the Pauline epistles. He was often a messenger to the churches, and tradition confirms this letter's implication that he was long the bishop of Crete. The epistle has but three chapters, which treat of the qualifications of a Christian minister, discuss the troubles of the Cretan church, and exhort Titus concerning the ideals he should set before the young and old of his congregation.

TITUSVILLE, a city in Crawford Co., northwestern Pennsylvania, situated on Oil Creek, 18 mi. north of Oil City; it is served by two railroads. There also is an airport. Wheat and potatoes are the principal crops of this region. Titusville is surrounded by extensive oil and gas fields and is an oil industry center with refineries, an oil well supply factory and large iron and steel product plants. The first artesian oil well in America was drilled here in 1859 by Col. Edwin L. Drake. The Titusville oil interests with the inspiration of John D. Archbold withstood the encroachments of the Standard Oil Company until 1875. About 1872 the pioneer venture in developing the natural gas fields of Pennsylvania began at Titusville. The city was settled in 1796; it became a borough in 1847, and was chartered in 1866. In 1892 a cloudburst caused Oil Creek to flood the city. Several tanks were destroyed and the water was covered with oil which caught fire, probably by lightning. Sixty lives were lost and one-third of the city devastated. Pop. 1920, 8,432; 1930, 8,055.

TITYUS, in Greek mythology, a giant of Euboea, son of GAEA or Elara and ZEUS. Offending either ZEUS or APOLLO he was cast into Tartarus where two vultures eternally fed on his liver.

TIVOLI, in ancient times *Tibur*, an Italian city situated about 18 mi. northeast of Rome, the seat of a bishop. It has extensive Roman remains, among them the round, so-called Temple of the Sibyl, and, most imposing of all, the magnificent ruins of Emperor Hadrian's villa. Here also are the Villa d'Este, with its Renaissance garden, a Papal citadel, and a cathedral of the 17th century, with a 12th cen-

tury tower. The industries include a paper factory and iron works, and there is a large tourist traffic. Pop. 1931, 19,223.

TIZIANO VECELLIO. See TITIAN.

TJAP PRINTING, a variety of block printing on silk or cotton material practised by natives of Java and the East Indies. It is an imitation of BATIK but because of the skill required to make the tjap blocks, tjap-printed materials are often as valuable as true handmade batik. Fine copper strips are carefully bent to form the design and the strips are set into the end grain of a block of wood. The blocks must be made in identical pairs, one for each side of the material. The blocks are dipped in wax and the material is stamped with the wax design. The rest of the process is like that of batik.

TLATSKANAI, a North American Indian tribe belonging to the Athapascan linguistic stock. They formerly occupied the prairies along the Chehalis River in Washington, but because of the lack of game crossed the Columbia River and lived in the mountains along the Clatskanie River in Columbia Co., Ore. They were a warlike group, demanding tribute from neighboring tribes. They have been extinct since the middle of the 19th century.

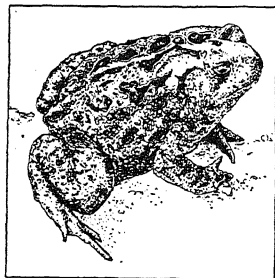
TLAXCALA, a state of Mexico, situated in the central part of the republic, with an area of 1,534 sq. mi., and a mean elevation of about 8,761 ft. With the slopes of Popocatepetl in the western part, and those of Penon del Rosario in the eastern, the climate is necessarily dry and cold over most of the state. Some of the loftiest mountains in Mexico are in Tlaxcala, the most important of these being Mt. Malintzi, about 13,000 ft. high. The soil of the valleys is suited to the production of cereals, especially wheat and the maguey plant. The town of Tlaxcala, with a population of 3,000, is the capital. Pop. 1921, 178,570; 1930, 204,424.

TLEMÇEN, Africa, an Algerian town in the department of Oran, encircled by walls and defended by a fort. It is an ancient town with constricted streets, numerous fountains, splendid mosques and a museum. An extensive trade is carried on, chiefly with Morocco, in carpets, wool, leather, linens, cottons, grain and cork. Pop. 1926, 26,758.

TLINGIT, a group of North American Indians occupying the southern coast of Alaska from Chilkat on Controller Bay south to the northern boundary of British Columbia with the exception of the east and south portions of Prince Edward Island occupied by the Kaigani or Alaskan Haida. They comprise the Koluschan linguistic group and include the following geographic groups: Auk, Chilkat, Henya, Huna, Hutsnuwu, Kake, Kuiu, Sanyakoan, Sitka, Stikine, Sumdum, Tagish, Taku, Tongas and Yakutat or Klahayik. The sea is their main source of food but they hunt land animals to a greater extent than other tribes on the north Pacific coast. Wood-carving is a highly developed art and finds a principal expression in totem poles. Settlements are divided into two exogamous social groups or phratries, the Yehl (Raven) and Goch (Wolf) or Chak (Eagle), which are subdivided into

consanguinal bands or clans. Descent is maternal. There are four social castes, chiefs, noblemen, commoners and slaves.

TOAD, the popular name for tailless amphibians which commonly live on land. The true toads (*Bufo*) usually have stout puffy bodies, rough and warty looking skin, and much shorter hind legs than their cousins, the frogs. There are about 100 species in the large genus *Bufo* alone. Toads are widely distributed, although the majority of species are tropical. Some exceptional kinds live in trees; some burrow in the earth, and some seldom leave the water. The mottled, earthy-colored common toad of North America (*Bufo lentiginosus*) is, however, typical of the family. It usually hides in odd corners during the day, and comes out at night to hunt for insects, snails and worms. In the spring it seeks the water, where the eggs are laid in long strings. The baby toads are very tiny. They transform while quite small, but they do not mature for about five years. Toads aid gardening by destroying insects and snails.



AMERICAN TOAD

TOADFISH, a small family (*Batrachoididae*) of spiny-rayed marine fishes of repulsive appearance, found chiefly in warm seas of the New World, some ascending rivers. They have robust, flattened bodies, thick often scaleless skin, large heads and mouths, and strong teeth. Toadfishes are carnivorous, voracious bottom-fishes, some possessing poison glands, and practically valueless for food. The common toadfish or oyster fish (*Opsanus tau*) occurs chiefly in shallow waters from Maine to Cuba, hiding among sea weeds, and hibernating in the mud during winter. It is sluggish in habit, usually less than a foot long, with loose, wrinkled blackish-green skin, and a broad toad-like head. In a tin can, old shoe, or crevice in a rock the toadfish deposits its heavy adhesive eggs, which it guards pugnaciously. The young have been said to possess a ventral sucking disk, by means of which they cling to rocks. As a matter of fact it is the egg that is adhesive, and the young, after hatching, is anchored by its yolk sac for a time.

TOADFLAX, the common name for a large genus (*Linaria*) of herbaceous plants of the figwort family. There are more than 100 species found widely throughout north temperate regions; seven species occur in North America. Several are grown as garden ornamentals; a few are widespread as weeds. They are usually small, smooth herbs with opposite or whorled leaves and showy, long-spurred flowers of many colors borne in terminal clusters. Those found most widely in North America are the blue toadflax (*L. canadensis*), a slender plant found across the continent, with delicate blue flowers bearing a thread-like spur, and the butter-and-eggs (*L. vulgaris*), with

showy yellow and orange-colored flowers naturalized from the Old World.

TOADSTOOL, a name formerly commonly applied to all mushrooms with an umbrella-shaped cap, especially to those regarded as poisonous, and also to various other mushrooms as morels and puffballs. See MUSHROOM.

TOBACCO (*Nicotiana Tabacum*), an herbaceous plant of the nightshade family cultivated extensively in many parts of the world for its leaves used for smoking and chewing and as snuff. The plant, believed to have been originally native to tropical America, is unknown in a truly wild state though it frequently escapes from cultivation. It is a coarse, rank-growing, sticky-hairy annual with an unbranched stem, 6 ft. or more high, bearing very large leaves, 1 to 2 ft. in length; long, trumpet-shaped, usually pink or rose-colored flowers and minute, exceedingly numerous seeds.

At the period of the Spanish discovery tobacco was used over a large portion of both North and South America. In North America from Panama and the West Indies northward to California and Canada smoking was universal. Tobacco pipes of elaborate workmanship have been found in great numbers in the tombs of the Aztecs in Mexico and also in many Indian mounds in North America.

Snuff-taking was first described by Ramon Pane who was with Columbus on his second voyage, 1494-96; tobacco chewing was first observed by Spaniards exploring the coast of South America in 1502. The tobacco plant was first introduced in Europe from Mexico in 1558 by Francisco Fernandes. The habit of smoking tobacco was initiated in Europe by Ralph Lane, the first governor of Virginia, and Sir Francis Drake, who delivered in England in 1586 tobacco and tobacco pipes to Sir Walter Raleigh. Since the 17th century the use of tobacco in various forms has become widespread throughout the world. A. B. J.

Cultivation. Few agricultural plants are more sensitive than tobacco to soil and climatic conditions; the former influencing the texture, the latter the aroma of the leaves. Though varieties differ widely in both respects these conditions are mainly instrumental in deciding the character of products grown in each principal locality. For instance, when Connecticut Valley "cigar wrapper" varieties are planted on the heavy clays of Tennessee they lose their character of lightness, thinness and elasticity and become inelastic and tough.

In northerly areas tobacco plants are started in hot-beds, in the south in nursery beds, five and six weeks before time to set them in the field. During this period they are protected from frost. In many areas the crop is grown beneath cheesecloth to insure high quality. On an extensive scale the seedlings are transplanted and cultivated by machinery. When they begin to form flower buds, their tops are cut, except with cigar leaf plants and unless seed is desired. When the foliage begins to turn yellow the plants are cut by hand during midday, usually near the ground.

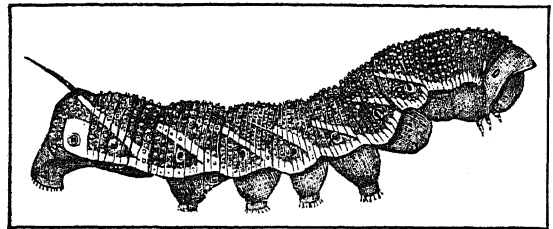
They are then cured in various ways both out of doors and in special barns. M. G. K.

TOBACCO MANUFACTURES, UNITED STATES. The tobacco industries embrace all establishments engaged primarily in the manufacture of (1) cigars and cigarettes and (2) chewing tobacco, smoking tobacco and snuff. According to the Census of 1930 the total value (manufacturers' sales) of tobacco products was \$1,246,241,839. To this total cigars and cigarettes contributed \$1,066,908,888 or 85.6% and other manufactured tobacco \$179,332,951 or 14.4%.

TOBACCO INDUSTRY, U.S., 1899-1929

Year	No. Establishments	Wage Earners	Wages \$	Value of Products \$
1899	14,959	132,526	47,975,331	263,713,173
1904	16,827	159,406	62,639,003	331,111,181
1909	15,822	166,810	69,354,594	416,695,104
1914	13,951	178,872	77,856,100	490,165,222
1919	10,291	157,097	123,988,084	1,012,933,213
1925	2,623	132,132	111,558,170	1,091,000,981
1929	1,788	116,119	94,578,749	1,246,241,839

TOBACCO WORM. This term usually means the larva of a large sphinx moth. It is applied also



TOBACCO WORM
Larva of a sphinx moth (*Phegathontius carolina*)

to other insects. Thus the CORN EAR WORM, when feeding on tobacco, is the tobacco false bud-worm.

TOBAGO, an island belonging to the BRITISH WEST INDIES, northeast of Trinidad, having an area of 114 sq. mi. The island consists of a mountainous peak rising 2,000 ft. from the sea. What little area is under cultivation is extremely productive. Tobacco and cotton are grown, and with coffee, nutmegs and sugar constitute the chief exports. Horses and sheep are raised in the valleys. Scarborough on the southern coast is the capital. Tobago was discovered by Columbus in 1498 and occupied by the British in 1580. Later owned by the French and the Dutch, in 1814 it reverted to Britain and has since been her possession. For administrative purposes Tobago is joined to TRINIDAD. Pop. 1931, 25,352.

TOBIAS, BOOK OF, one of the apocryphal books of the Old Testament which is received in the Catholic canon. The book derives its title from its chief character. The Latin Church views it as the historical narrative of the holy man Tobias, who receives help from the angel Raphael, lives to be 102, counseling his descendants, the while he foretells the destruction of Nineveh and the rebuilding of Jerusalem. Many modern scholars hold that internal evidence proclaims

it a romance, dating from about 170 B.C. "Is it history?" wrote Luther, "then it is holy history. Is it fiction? then it is a truly beautiful wholesome fiction."

TOBOGGANING, coasting down snow-covered hills or constructed toboggan slides. The sport derives its name from *tobaakan*, the Indian sledge. The modern toboggan is adapted after the Indian original, constructed from a single piece of broad birch or basswood, and curved back at the front. In length it may measure from 3 to 8 feet, and in width from 2 to 3 feet. The body is strengthened by hardwood struts nailed across the grain at short intervals. On the more spectacular runs, such as exist in Canada and at Davos, Switzerland, the runners guide their toboggans by means of spiked boots, also used for braking around turns, and sometimes wear pads on knees and arms and a steel helmet to minimize injury in the event of a spill at high speed. In Switzerland the sport is called *lugeing*, and enjoys great popularity with winter visitors. The toboggan season in most countries is fairly restricted, for good running is obtained only on a surface of soft, light snow. In parts of Canada and in Alaska, the toboggan is hauled by dogs, or huskies, and is used for transportation of food and supplies between villages and settlements. In Alaska a toboggan derby between regional runners and dogs is staged over long stretches of frozen country, and the winner is sometimes awarded a cash prize of considerable value.

TOCCATA, in music, a "show piece" exhibiting the technical skill of the performer. Like the *Étude*, it cannot be considered a musical form since it has no established pattern, but numerous composers have made use of the title for compositions unusually difficult or elaborate. J. S. BACH's toccata in F-major for the organ and ROBERT SCHUMANN's toccata in C-major for the pianoforte are two fine examples.

TOCQUEVILLE, ALEXIS HENRI CHARLES MAURICE CLEREL, CONTE DE (1805-59), French political philosopher and historian, was born at Verneuil on July 29, 1805. His father became a peer of France at the Restoration and his mother was a granddaughter of Malesherbes, who defended Louis XVI at his trial. He studied law and was made an assistant magistrate, but becoming interested in prisons and public welfare he went with his friend G. de Beaumont on a mission of the French Government to America to study prisons, 1831-32. After his return, he published *Du système pénitentiaire aux États Unis*, 1833, and two years later his great work *De la démocratie en Amérique*, which passed through numerous editions and translations. It attracted much attention in England among the leaders of the humanitarian group, and he was invited to visit that country. In 1836 he was elected to the Academy of Moral and Political Sciences, and in 1841 was made a member of the French Academy. Two years before, he had been elected to the French Chamber of Deputies, where he soon aligned himself with the opposition against Guizot and Louis-Philippe. After the revolution of 1848 he opposed the Socialists and Radicals

on the one hand and Louis Napoleon on the other, and became vice-president of the Assembly, serving as Minister of Foreign Affairs from June to Oct. 1849. His known liberal views and his staunch opposition to Napoleon caused his arrest in 1851 and his retirement from public life. In 1856 his second important work, *L'ancien régime et la révolution*, appeared. Its success was almost as great as that of his earlier work.

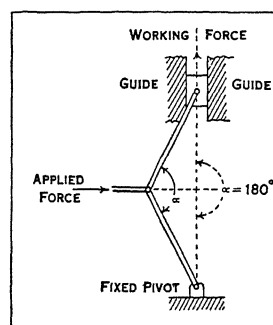
Tocqueville won deserved distinction because he formulated clearly and attractively the liberal ideas of his day. His account of democratic government in America constituted a valuable contribution to the political thought of his time because it was based on first-hand observation of a democracy at work. His work on the Ancient Régime is often referred to as the first philosophical treatise on political history.

Never very robust, Toqueville was ordered south for his health and took up his residence at Cannes where he died, Apr. 16, 1859. His complete works were published by Madame de Tocqueville in *Oeuvres complètes d' A. de Tocqueville*, 8 vols., 1864-65, preceded by *Oeuvres et Correspondence inédites d' A. de Tocqueville par G. de Beaumont*, 2 vols., 1861.

TODD, DAVID (1855-), American astronomer, was born at Lake Ridge, N.Y., Mar. 19, 1855. After graduating from Amherst College in 1875 he served as assistant on the U.S. Transit of Venus Commission and the Nautical Almanac until 1881 when he returned to Amherst as professor of astronomy and navigation, remaining there until he retired in 1920. From 1882 to 1887 he was likewise professor at Smith College and designed and erected new observatories both there and at Amherst. From 1887 to 1919 he took part in eleven scientific expeditions and in 1925 made the first airplane photographs of the solar corona. He wrote numerous scientific articles and books, including *Lessons in Astronomy*, 1902, and *Astronomy Today*, 1924.

TODD, MABEL LOOMIS (1858-1932), American author, was born in 1858 at Cambridge, Mass., and educated in Washington, D.C., and Boston. She traveled around the world with her husband, David Todd, to observe eclipses of the sun in Japan, Tripoli, Barbary, Dutch East Indies, Chile and Russia. Her works deal chiefly with astronomy and travel, and include *Footprints*, 1883, *Total Eclipses of the Sun, Corona and Coronet* and *A Cycle of Sunsets*, 1909. Mrs. Todd also edited the poems and letters of Emily Dickinson and *Steele's Popular Astronomy*, 1899. She died at Muscongus, Me., on Oct. 14, 1932.

TOGGLE LEVER, a mechanical device comprising two rigid bars or rods connected to form a joint



TOGGLE LEVER

resembling that of the elbow or knee. The free end of one of the rods is pivoted to a fixed object, as the frame of a machine. The free end of the other is pivoted to a working object, as a crushing jaw, which moves in a guide. Power is applied to the lever at the joint between the rods. As this joint is moved in the direction which causes the included angle to be increased toward 180° , the applied force is transmitted to the working end of the lever in magnitudes increasing toward infinity at 180° .

TOGGLE PRESS, a press operated by a combination of levers known as a toggle, as shown in the figure.

TOGO, HEIHACHIRO, COUNT (1847-1912), Japanese admiral, was born at Kagoshima, Dec. 22, 1847. He belonged to the Satsuma clan. At the age of 24 he went to England and studied the organization of the British Navy for seven years. During the Sino-Japanese War his command of the cruiser Naniwa operating in the Yellow Sea earned him promotion to Rear Admiral. At the outbreak of the Russo-Japanese War he was a Vice-Admiral and a year later was created Commander-in-Chief of the Naval Staff, directing the entire naval conduct of the war. He was personally in command of the Japanese fleet at the Battle of Tsushima, May 27, 1905, when the Russian Baltic fleet, sent to the relief of Port Arthur, was completely annihilated. Four years later he was appointed to the Supreme War Council and early in 1912 was created Admiral of the Fleet. At the death of the Emperor Meiji he committed hara-kiri at Tokyo, July 30, 1912.

TOGOLAND, a former German protectorate in West Africa, between the Gold Coast Colony on the west and Dahomey on the east. After the World War the country was divided between France and Britain as mandated territory of the League of Nations. Two-thirds of the total area of 33,700 sq. mi. belong to France. The natives, forming a population of 730,027, are of Ewe stock in the south, and Hamitic in the north. They are for the most part pagans. There is a European population of 477.

Togo, or French Togoland, has an area of 21,893 sq. mi., consisting chiefly of hilly land rising to an elevation of 3,600 ft. Numerous streams and waterfalls are found in the district. In 1913 the country was Germany's only self-supporting African colony. Palm-oil products, copra, cocoa, peanuts and sisal are among the exports. The production of cocoa has been recently developed and cotton now covers nearly 200,000 acres. About 1,500 tons are now exported annually. Lome, the administrative center, is the meeting point of three lines of railway and is the location of a large cotton ginning factory.

British Togoland, administered as a British mandate from the Gold Coast, has an area of 12,600 sq. mi.; with a population of 188,265 in 1921, which includes only 15 Europeans. The territory borders the Gold Coast, but no part of it touches the sea. Principal exports are palm oil and kernels, cocoa, kola nuts and cotton. Expenditure greatly exceeds revenue.

TOILERS OF THE SEA (*Les Travailleurs de la Mer*), a powerful romance written by VICTOR HUGO; published 1866. It dramatically portrays the life of Guernsey seamen. When the *Durand*, the newly invented steamboat of old Lethierry, is steered onto some rocks by the villainous Captain Clubin, who intends to make off with a large booty, Lethierry's niece, Deruchette, promises her hand to any man who will raise the ship. A young fisherman, Gilliat, attempts the superhuman feat, and for months labors alone and unaided to save the *Durand*, struggling mightily against the sea and the elements, narrowly escaping from death a hundred times, especially in his battle with a gigantic octopus. But his herculean efforts are poorly rewarded, for he sees Deruchette sail past one day with her newly wedded husband, and, overcome with grief, the hero lets the tide rise over him.

TOILET WATER. See PERFUMES.

TOKHARIAN, an extinct language spoken up to the 7th century east of the main area of SOGDIAN. It constitutes an independent branch of INDO-EUROPEAN, is remarkable as being the only Asiatic member of that family which belongs to the *centum*-group (see CENTUM-LANGUAGES), and appears to stand midway between ITALIC and CELTIC on the one hand, and SLAVIC and ARMENIAN on the other. It falls into two dialects provisionally called Turfanian and Kuchaeian, and is written in an Indian alphabet with a considerable literature, chiefly Buddhistic and mainly translated from SANSKRIT.

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TOKUGAWA ERA, the period of the last Shogunate in Japan, starting in 1603 when Iyeyasu, head of the Tokugawa clan, after defeating various rivals, assumed control of the administration, and lasting until the abolition of the Shogunate and the transfer of real as well as nominal power to the emperor at the beginning of 1868. Iyeyasu proved himself an exceptionally able administrator, and the feudal system which he developed out of earlier beginnings kept peace throughout the country for over 200 years. At the start he had sought to build up foreign commerce, and he permitted Christian missionaries to preach in Japan, but before long he became disturbed over the claims to the temporal power of the pope which were put forward by the Catholic priests and, following the discovery of a conspiracy in which Japanese and foreign Christians were involved, he proscribed Christianity in Japan in 1612 and began drastic measures to suppress the faith. The program was continued by his successor, though some of the feudal lords were slow to follow the Shogun's decrees. In 1636 the Shogun, Iyeyasu's grandson, issued a strict seclusion edict, prohibiting Japanese travel abroad and allowing only one foreign ship (Dutch) to visit Japan each year. This seclusion edict was not cancelled until 1866.

TOKYO, the capital of Japan; situated 18 mi. from the seaport of Yokohama, midway between the southwestern and northern extremes of the Pacific coast,

on Hondo, the main island of Japan. The city covers more than 50 sq. mi. and has not only a hilly section but low land surrounding the Sumida River, which flows through Tokyo's eastern section.

Contrasting skyscraper office buildings, wide roads and tramways with the Imperial Castle, survival of the Middle Ages, and old temples of historical interest, Tokyo combines the ancient inheritance of Nippon with the modernity of industrial Japan. The city has a sewage plant, planned for a population of 3,000,000, waterworks and the first subway line in Japan, extending a little over a mile. The earthquake and disaster by fire in 1923 was quickly followed by reconstruction. Jinrikishas, long the main vehicle of the capital, are now giving way to the automobiles and electric tramways that unify the wide distances of Tokyo. Branches of the Sumida River carry sampan traffic, although the waters are difficult for navigation.

Most important for its financial and administrative power, Tokyo has a water outlet through Yokohama, and is connected with all the main centers of Japan by railway lines. The city is divided into 15 administrative districts, or *Ku*, and is governed by assemblies. These wards are Yotsuya, Hongo, Akasaka, Azabu, Kojimachi, Koishikawa, Ushigome, Shiba, Kyobashi, Kanda, Nihonbashi, Honjo, Shitaya, Asakusa and Fukagawa. Tokyo has the largest educational institution in Japan, the Imperial University, which usually has an enrollment of about 7,700. Technical schools giving agricultural and commercial courses also flourish.

The present name of the city, meaning Western Capital, has existed only since the Restoration of 1868, when the shoguns were deprived of their rulership and their city, Kyoto, Eastern Capital, was reduced to its present political insignificance by the Emperor Meiji. Tokyo, first under the name of Yedo, came into power at the end of the 12th century, when Yedo Taro, a general and assistant of the early shogun, Minamoto Yoritomo, made the town his residence. *Ote* Dokwan built the first castle in Yedo about 270 years later. The first of the Tokugawa shoguns, Tokugawa Ieyasu, established his home in the city in 1590 and made it the seat of government. Yedo as an administrative and financial center was rivaled only by Kyoto, which had the Imperial tradition behind it.

Yedo's architectural charm owed much to the jealous eye of the shogun, who, to insure the good behavior of the feudal lords, or Daimyos, required them to spend residential periods in the city every three years. These aristocratic dwellings remain, as do the Imperial Palaces, whose miles of inclosing wall rise on the medieval moat. Main points of historical interest include the Meiji Shrine, dedicated to the Emperor Meiji, the Yasunuki Shrine on *Nidan* Hill, and Sengaku-ji Temple, where are the graves of the famous 47 Ronins. Their story is among the most celebrated in Japanese history. All 47 died by *hari-kari* after they committed the offense of revenging

with the blood of a nobleman an insult to their liege lord. Knowing the penalty, their loyalty, nevertheless, led them to their vengeance. Luxuriant flowers, including plum and cherry blossoms and wistaria, make several gardens show places of the capital.

Once ranked as the fifth largest city in the world, and usually considered the premier city of Japan, Tokyo has a population not accurately computed. Census figures of 1930 gave it as 2,070,913. (See JAPAN.)

TOLEDO, FRANCISCO DE (1515-84), fifth Viceroy of Peru from 1569 to 1581, was one of the greatest of the colonial governors. He introduced many improvements and reforms, issued Ordinances regulating local government, especially with regard to the aborigines, and codified the laws of Peru in the *Libro de Tasas* (1580), which for 200 years was the basis for the administration of the viceroyalty. He took particular interest in the good government of the Indians. Yet to destroy the last vestiges of loyalty to the native Inca dynasty, he seized and executed at Cuzco the surviving Inca, Tupac Amaru, and persecuted the family. In 1573 he introduced the mercury process into the silver mines of Potosi. He also first organized the University of San Marcos in Lima on an effective basis, establishing chairs of Latin, philosophy, theology, law and Quechua. It was during his time that Sir Francis Drake harried the coast of Peru on his voyage circumnavigating the globe.

TOLEDO, a city of Spain, capital of the province of the same name in the central part of Spain south of Madrid. Located in the midst of a treeless plateau, on a rocky promontory, it is almost surrounded by the Tagus River which, with the remnants of its embattled walls, contributes to its fortress-like appearance. Within the city, which exists to-day only as a record of past Spanish glories, the streets are narrow, winding and steep, unsuited to the traffic of modern times. The finest building is the Gothic cathedral begun in 1226 but not finished until 1493, which accounts for the variety of styles incorporated in its chapels and altars. The interior of the cathedral is a treasure house of painting, sculpture, carving and stained glass. Second to the cathedral in importance is the 15th century church of San Juan de los Reyes with its beautiful cloisters. The Church of Santa Maria la Blanca, formerly a synagogue, is famous for its original capitals of pineapple design, and in the church of Santo Tome is the famous painting of the Burial of the Conde de Orgaz by EL GRECO. The Transito synagogue is an interesting example of Jewish art, built in the 14th century by the treasurer of the king, Don Pedro. Near the synagogue is the former house of El Greco, which has been restored and is to-day a museum for his paintings.

The Alcazar, or palace of Charles V, which stands on the highest point of the city, has been greatly restored, as has the Hospital de Santa Cruz, though the latter still remains one of the finest Renaissance

buildings in Spain. The Tagus River is crossed by two Moorish bridges of which the Alcantara is the more famous of the two as is also the 12th century Moorish gateway, Puerta del Sol.

In addition to the famous Toledo blades, the city also produces silk, gold and silver materials for church vestments. Toledo, called *Toletum* by the Romans, became a Roman colony and was famous at that time for the quality of its steel weapons. Later it was the residence of the kings of the West Goths and under the Moors became an independent state. Captured by the Cid in the latter part of the 9th century it became the capital of the kingdom until the 14th century. Toledo was the seat of the first archbishopric of the Spanish church. Est. pop. 1929, 26,000.

TOLEDO, a city of northwestern Ohio, a port of entry and the county seat of Lucas Co., situated at the mouth of the Maumee River on Maumee Bay, the southwestern tip of Lake Erie, about 95 mi. west of Cleveland. It is served by 14 trunk railroads and several branch lines. Additional transportation is afforded by lake steamers, electric traction, bus and truck lines and a commercial airport on the trans-continental line. Toledo has a fine harbor, with excellent docking and terminal facilities.

The city lies on both sides of the Maumee River, with seven connecting bridges. Its residential district is shaded and quiet; its business section studded with tall hotels and business buildings. There is an extensive park system, running along the river edge, and connected by broad boulevards. The city has a large zoological garden.

Toledo's location at the head of direct water transportation to the east and its superior railway facilities for transportation westward and southward have encouraged industrial development. It is the center of the world's glass, children's vehicles, and oil well producing machinery industries. The city is one of the country's leading markets for clover seed, hay, grain, coffee, spices and winter vegetables, and one of the largest distributing points on the Great Lakes for soft coal, iron ore and lumber. In 1929 270 wholesaling organizations proper distributed \$100,346,518 worth of merchandise; the retail stores, 3,743 in number, which did an aggregate business of \$174,046,566, gave full-time employment to 14,414 people. Toledo's manufactures, which had an approximate value of \$420,000,000 in 1929, included automobiles, tobacco products, electrical machinery, refined petroleum, glass, canvas goods and chemicals.

The site was obtained from the Indians in 1795, and the first fort was erected in 1800. Toledo received its city charter in 1846. It has an excellent zoo and an outstanding art museum. It is the seat of the University of the City of Toledo. Pop. 1920, 243,164; 1930, 290,718.

TOLEDO, UNIVERSITY OF THE CITY OF, a municipal coeducational university established in Ohio in 1872 as a School of Design. It was taken over by the City of Toledo in 1884, and although given the

title of university, was not conducted on a collegiate basis until 1909. The university holds night as well as day classes, with credit from either leading to a degree. It is wholly supported by taxation. The grounds and buildings were valued in 1931 at \$3,132,594. The library contained 32,002 volumes. In 1931-32 there were 2,457 students, and a faculty of 64, headed by Pres. Henry John Doermann.

TOLERANCES, the amount of variation permissible in the ASSEMBLING of machined parts, representing the amount of inaccuracy that can be tolerated and yet produce satisfactory results. Tolerances are sometimes confused with *limits*, which are the upper and lower dimensions of the tolerance. In a piece whose dimensions are given as 2 inches plus 0.001 inch, the tolerance is 0.001 inch, but the limits are 2 and 2.001. See PRODUCTION, INTERCHANGEABLE; FITS AND TOLERANCES.

TOLGUACHA (*Datura meteloides*), a handsome herbaceous perennial of the nightshade family, native to the southwestern United States and cultivated in



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TOLGUACHA

Fruit and flowering branchlet

gardens as an annual. It grows about 2 ft. high, with slender, forked stems bearing grayish foliage and trumpet-shaped, fragrant flowers, white tinged with purple or violet and often 6 in. across. By various Indian tribes the plant is used medicinally for its narcotic properties.

TOLIMA, a volcanic mountain of Colombia, a peak of the northern Andes, 75 mi. west of Bogota. Rising to a height of 18,314 ft. Tolima has been quiescent since 1826 and 1829, when columns of vapor rose from the central crater. It has developed several parasitic cones on its flanks, while solfataras have sprung up on the surrounding *paramos* as far down as the Quindio Pass. The slopes are covered with the rapidly growing *Yaragua* grass. It is tick-free, owing to small globules of oil on the stems, and is an excellent forage for fattening.

TOLLER, ERNST (1893-), German dramatist and poet, was born at Samotchin, Dec. 1, 1893. Well known as a Socialist, he was imprisoned for his part in the Munich Revolution of 1919. During imprison-

ment he wrote two volumes of poetry, *Gedichte der Gefangenen* and *Das Schwalbenbrich*, 1924. Toller's plays are revolutionary in theme, and his *Masse Mensch*, 1921, showed such unusual treatment that the author was credited with bringing an entirely new form of art into the theater. Later dramas by Toller include *Die Maschinenstürmer*, 1922, and *Hinkemann*, 1924.

TOLLEY, WILLIAM PEARSON (1900-), American educator, was born at Honesdale, Pa., Sept. 13, 1900. He graduated from Syracuse University, 1922; Drew Theological Seminary, 1925; and Columbia University, 1927. From 1925-31, he was connected with Drew University, becoming dean of Brothers College in 1929, and professor of philosophy in 1930. In 1931 he left Drew to become president of Allegheny College. He is author of *The Idea of God in the Philosophy of St. Augustine*.

TOLOWA, an American Indian tribe belonging to the Pacific Coast group of the Athapascan linguistic stock. They occupied the northwestern Californian coast from the mouth of the Klamath River almost to the Oregon boundary, including the Smith River Valley. Though gathered on a reservation for a few years following 1862, this attempted segregation proved unsuccessful and the Tolowa were dispersed. Culturally they resemble the nearby Hupa and Yurok. In 1931 less than 100 Tolowa, largely mixed-bloods, survived.

TOLSTOY, LEO (LIOV) NIKOLAEVICH, COUNT (1828-1910), Russian novelist, philosopher and social reformer, born at Yasnaya Polyana, Tula Province, Aug. 28, 1828. He studied at the University of Kazan, plunged into social life in St. Petersburg, joined the army in the Caucasus, and passed through the Siege of Sebastopol in 1854. After his marriage in 1862, he settled down and occupied himself with managing his estates and providing for the welfare of a large family. At this period, 1865-75, Tolstoy wrote his masterpieces, *War and Peace* and *Anna Karenina*. The former is an artistic, historic and philosophic epic of fiction depicting the growth and development of every element in the national life of Russia; *Anna Karenina* is a masterly story of love and of moral disintegration.

In 1879 occurred the religious crisis that turned Tolstoy to mysticism and renunciation. Thereafter he was more the moralist and social reformer than the artist. The best known of his later works are *My Confession*, 1879-82, a gloomy, philosophical analysis of the futility of art and life and the way out by self-sacrifice and love; *Kreutzer Sonata*, 1900, a story of love and jealousy, carrying the implication of war on sexual love and imposing the ideal of absolute chastity; and *Resurrection*, 1900, a novel in which Tolstoy excoriates the state, laws, church and conventional morals and preaches the way to regeneration. Among his other works are *What is Art?*, 1896; *The Death of Ivan Ilyich*, and several plays, of which the finest is perhaps *The Living Corpse*. Tolstoy was one of the most celebrated philosophical anarchists of modern

times. He died at Astapovo, Nov. 20, 1910. See also RUSSIAN LITERATURE.

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TOLTEC, an ancient people of Mexico who are the subject of much controversy as to their origin, period and influence on other Mexican and Central American Indians. According to some authorities they are believed to have been a *Nahua*-speaking people who reached the height of their power between 900 and 1100 and lived in the valley of Mexico where they had an important part in the building of the cities of San Juan Teotihuacan, Atzacotzalco and Tula. Aztec legends are rich in tales of the Toltec and modern archeology is bringing to light details of these heretofore mythical people. It is known that under three great emperors, Huetzin, Ihuitimal and Quetzalcoatl, the Toltec extended their rule from Durango to Guatemala and that they extorted tribute in the form of precious stones, metals and food from conquered tribes. Their three seats of government were Teotihuacan in the valley of Mexico, Chichen Itza in Yucatan, and Iximché in Guatemala. Pulque, the national drink of Mexico, fermented from the sap of the agave, is supposed to have been invented by the Toltec.

TOLUENE, or **TOLUOL**, a colorless liquid (methylbenzene, $C_6H_5CH_3$), boiling at $111^\circ C.$, /760 mm., was first discovered by Pelletier and Walther (1838). It is found in the products of distillation of Tolu balsam and a large number of other naturally occurring materials. Commercially, toluene is obtained from COAL TAR by fractional distillation of the portion boiling between $100-120^\circ C.$ It is also, produced by treating a mixture of benzene and xylene (dimethyl-benzene) with aluminum chloride at elevated temperatures. Oxidation converts toluene to benzaldehyde, benzoic acid and other more complex compounds.

Toluene is used commercially for the manufacture of nitrotoluene, the toluidines (aminotoluenes), benzaldehyde, benzoic acid, cinnamic acid, benzyl chloride, benzal chloride, benzo trichloride, etc. Many of its derivatives, e.g., the nitrotoluenes and toluidines are used in the dye industries. TRINITROTOLUENE (T.N.T.) is made by the action of mixture of concentrated sulphuric and nitric acids on toluene. It is a very valuable high explosive. L. C. A.

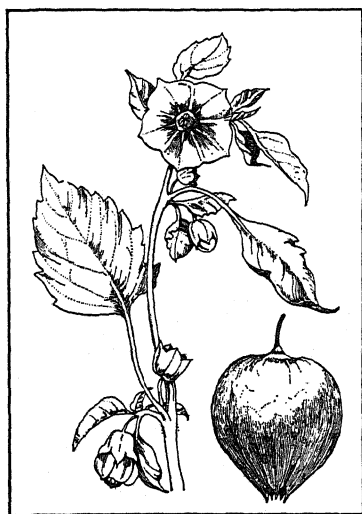
TOLUCA, a city of Mexico, and capital of the state of Mexico, situated about 45 mi. southwest of Mexico City at an altitude of 8,761 ft. above sea level. Among its industries are stock raising, brewing, corn, flour and cotton milling and tanning. Facing the main plaza is the Governor's Palace, built in 1872 on the site of the old guildhall which was occupied for a long time by the son of Cortéz. There are schools of art and sciences, a conservatory of music and a small museum which contains some interesting Indian relics. It was founded by Cortéz in 1533. The first

village was called Toloacan. Pop. 1921, 34,265; 1930, 81,630.

TOM, MOUNT, a small but steep mountain in the Connecticut valley, directly opposite Mt. Holyoke and about 4 mi. south of Northampton in Hampshire Co., Massachusetts. An incline railway some 1,200 ft. long has been built up the side of the mountain and from the summit there is an excellent view of the Connecticut valley and surrounding regions. A tract of 1,700 acres on the mountain including a large Boy Scout camp has been turned into a state park.

TOMAHAWK, a light war ax used by the Indians of North America. A tomahawk usually consisted of a sharp-edged piece of stone inserted near the end of a wooden stick which served as handle and was held fast with leather thongs. Frequently the stone was sharpened on both ends approximating the modern double-ax. Occasionally the heads were made of deer horn. Tomahawks were also used as hatchets. The blunt side of the stone head was sometimes made into a pipe bowl which connected with a hollow in the handle, forming a tobacco pipe. Iron gradually superseded stone and horn as hatchet heads with the coming of the white man. The phrase "bury the hatchet" comes from the old Indian custom of ceremoniously burying their tomahawks when they made peace and digging them up again when they went to war.

TOMATILLO (*Physalis ixocarpa*), a smooth annual of the nightshade family, sometimes called strawberry tomato. It is a native of Mexico often culti-



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TOMATILLO
Flowering branchlet and fruiting calyx

vated for its edible fruit and more or less naturalized in the warmer parts of the United States. The erect branching stem, 3 to 4 ft. high, bears thin, oblong, toothed or notched leaves, and bright yellow flowers spotted in the center with brown. The husklike, purple-veined calyx is completely filled and sometimes ruptured by the large, round, purplish berry.

TOMATO, a sprawling herb (*Lycopersicon esculentum*) of the nightshade family native to South America. Though introduced into cultivation in Europe during the 16th century it was long grown only as a curiosity because it was considered poisonous. Until the 19th century it was called "love apple" and was thought to have aphrodisiac properties, and under this name, *The American Gardener*, the first American book on gardening, 1804, devotes only ten lines to it and merely remarks that "the fruit is used for sauces and pickles." Not until about 1830 did it begin to be generally known as tomato and to commence its important evolution to the rank of third place among commercial vegetables, concerning which several books, scores of government and state bulletins and thousands of magazine articles have been written. During this period the originally small, wrinkled, seedy fruit has developed hundreds of varieties, many of which are smooth and globular and have almost solid pulp. Tomatoes range in size up to specimens weighing more than a pound. There are also currant, cherry, pear and plum varieties whose numerous little clustered fruits ripen more or less uniformly and are popular in home gardens for preserving.

Though each year countless tons of tomatoes are grown by home and market gardeners, the chief commercial interest in the plant is for canning, and for soup and ketchup making. For these purposes it is more extensively grown than any other vegetable, 500,000 acres being estimated as the annual area devoted to it.

Statistics of the production and canning of tomatoes in the United States for recent years are as follows:

TOMATOES, MARKETING FRESH, PRODUCTION, U.S.

4-Year Average, 1927-30

Division	Acreage	Production (Bu.)	% of Tot. Prod.
UNITED STATES	149,780	16,922,000	100.0
LEADING STATES:			
Florida	32,760	3,033,000	17.9
Texas	22,625	2,217,000	13.1
New Jersey	10,975	2,201,000	13.1
California	22,268	1,980,000	11.7
Mississippi	14,753	1,580,000	9.3
Tennessee	7,775	965,000	5.7
Maryland	4,800	645,000	3.8

TOMATOES FOR CANNING, COMMERCIAL PRODUCTION, U.S.

4-Year Average, 1927-30

Division	Acreage	Production (Tons)	% of Tot. Prod.
UNITED STATES	292,312	1,290,650	100.0
LEADING STATES:			
California	34,813	234,700	18.2
New Jersey	34,750	186,825	14.5
Indiana	57,925	142,325	11.0
Maryland	28,955	112,875	8.7
New York	13,035	76,900	5.9
Ohio	11,238	57,825	4.5
Delaware	14,000	56,325	4.4

Tomatoes generally preceded by lettuce, are also extensively grown in greenhouses from the Mississippi valley to the Atlantic coast. The tomatoes are planted in February or March for spring and early summer use because the larger yields and lower cost at that time more than offset the higher prices but also higher cost of late fall and winter tomatoes.

In the cold states tomato seed is sown indoors during late winter, the seedlings transplanted to "flats" and from these usually direct to the open ground, though sometimes to intermediate flower pots. Exceptionally valuable plants, especially for forcing, are often propagated by cuttings. The plants enjoy rich, well-drained sandy loam. In field culture they are planted in squares five feet apart so cultivation may be given each way until the vines cover the ground. In gardens they are often trained to stakes and trellises to keep the fruit off the ground. They have no important insect enemies but several diseases often cause serious damage. These may be largely prevented by spraying and dusting with fungicides.

M. G. K.

TOMBIGBEE RIVER, a river of Mississippi and Alabama, rising in Prentiss Co. in the northeastern part of Mississippi. Starting in a generally southeasterly direction, it enters Alabama in Pickens Co. and continues southeastward until it unites with the Alabama to form the Mobile River. This river is about 500 mi. long and has a current which is rapid at highwater and sluggish at low water. To make it navigable its bed has been dredged and locks and dams built at intervals, thereby providing a channel 6 ft. deep at low water as far as Columbus, a distance of 149 mi. At high water navigation extends to Walkers Bridge, 169 mi. farther. Forest products, sand and gravel are the chief cargoes transported.

TOM BROWN, the hero of *Tom Brown's School Days*, 1857, and *Tom Brown at Oxford*, 1861, by Thomas Hughes. He is a typical English schoolboy, manly, good natured, fond of sports, and keenly adventurous.

TOMBS, THE, the city prison of New York, so named because of the building's dreary appearance. The first Tombs, built in 1838, was torn down in 1898 to make way for a larger building. It adjoins the Court House, with which it is connected by the BRIDGE OF SIGHS.

TOMCOD (*Microgadus tomcod*), a marine fish of the cod family (*Gadidae*), called also frost fish, abundant on the Atlantic coast from Labrador to Virginia and often running up into fresh water. Though similar in appearance to the common cod, it is much smaller, usually ranging from 9 to 12 in. in length. It lives at the bottom, feeding largely upon small invertebrate animals. Though esteemed as a panfish the tomcod is of limited commercial value. The California tomcod (*M. proximus*) is common on the Pacific coast from Monterey to Alaska.

TOM JONES ("The History of Tom Jones, A Foundling"), one of the earliest and greatest English novels, by HENRY FIELDING; published 1749. Tom

Jones, a foundling, is raised by the kindly Mr. Allworth, until he becomes so irrepressible in his high-spirited dissipations that he is left to his own devices. He lays ardent suit to Sophia, daughter of the gruff fox-hunting Squire Western, but is balked not only by the irascible squire and by the unctuous Mr. Blifil, who plans to marry Sophia himself, but also by his own romantic temperament which is continually bringing him to disgrace. After a long rambling journey full of adventures, on which he is accompanied by his lovable old tutor, Partridge, the hero returns and carries off Sophia, a sin for which he is fully forgiven when the mystery of his birth is explained. *Tom Jones* stands out for its rich and varied sense of life and perhaps as the first English novel to have a definite, well-sustained plot. Some of its robust humor and its complications of adventure were borrowed from the PICARESQUE NOVEL, but to this species of writing Fielding repaid his debts with generous interest.

TOMMY ATKINS (often simply "Tommy"), a nickname for the British soldier. It came into popular use with the Government's custom of printing "Tommy Atkins" instead of "John Doe" or some such fictitious name on specimen documents, indicating the spaces in which the soldiers were to sign their names.

TOMPKINS, DANIEL D. (1774-1825), American political leader, was born in Fox Meadows (now Scarsdale), N.Y. After his graduation from Columbia College in 1795, he studied law and was admitted to the bar in 1797, beginning practice in New York City. As a prominent figure in the REPUBLICAN (later the Democratic) PARTY of New York, he was a delegate to the State Constitutional Convention, 1801, and was elected to the Assembly in 1803. In 1804, he was elected to the national House of Representatives, but he resigned before the beginning of the congressional term to accept an appointment as associate justice of the New York Supreme Court, serving from 1804-07. Tompkins was the governor of New York State from 1807 until 1817. During the War of 1812, he distinguished himself by his energetic, tireless efforts successfully to prosecute the war. He gave unstintingly of his time and of his large personal fortune to sustain the credit of the national government and to equip the militia. He refused President J. MADISON's proffered appointment as Secretary of State in 1813. He was elected vice-president on the ticket with James MONROE in 1816 and again in 1820. Rumors and accusations during his second term as vice-president that his large monetary expenditures during the War of 1812 had been for his personal enrichment and not wholly for the public welfare bothered Tompkins and affected his health during the last few years of his life. He died in Tompkinsville, Staten Island, New York, June 11, 1825.

TOM SAWYER, a classic of boy's life, by Mark Twain (see S. L. CLEMENS); published 1876. Tom Sawyer is one of the liveliest, most entertaining char-

acters in fiction, and his adventures in his native town on the Mississippi, as recorded in this book, are fully as appealing to adult readers as to growing boys. Among the memorable incidents in Tom's career is that of the "Glorious Whitewasher," when the hero discovers that other people will rush to do one's work, even to whitewashing fences, if the work is made to seem sufficiently attractive. The climax is reached in an exciting treasure hunt in a great river-cave. Important characters are HUCKLEBERRY FINN, Sid (Tom's model brother), Aunt Polly and Tom's sweetheart, Becky Thatcher.

TOMSK, administrative center of the Tomsk district of the Western Siberian Region of the R.S.F.S.R., on the Tom River, at its confluence with the Ushaika, amidst plain and swamp land. Here trade and industry for the entire area of the Western Siberian Region are carried on, the former largely through the branch-line connection with the Trans-Siberian Railway. Its cultural preeminence has earned it the title of the Siberian Athens. Tomsk has a fine technological institute with a splendid library and numerous other educational institutions. It is among the oldest of Siberian towns, beginning as a fort in the first years of the 17th century; formerly it ranked as one of Siberia's leading administrative centers. The discovery of gold in 1824 and the establishment of a gold-smelting laboratory heightened its commercial importance. During the civil warfare following 1917 it was the headquarters of the Siberian revolutionary movement. Pop. 1926, 92,274.

TOM THUMB. 1. The dwarfish hero of an old nursery tale, supposed originally to have been knighted for his services to King Arthur and, after many extraordinary adventures, to have been killed by a spider's poisonous breath. In 1621 Richard Johnson published a prose *History of Tom Thumb*. A similar tale in French, *Le Petit Poucet*, was published by Charles Perrault in 1630. 2. "General Tom Thumb," Charles S. Stratton (1838-83), a dwarf, born in Bridgeport, Conn., standing only about two feet high, who was exhibited for many years by P. T. Barnum. 3. A burlesque opera, from a dramatic work by HENRY FIELDING, 1730, produced by Kane O'Hara in London, 1778.

TON, a measure of weight equivalent to 20 hundredweight, or 2,000 lbs. avoirdupois (a short ton), in the United States and Canada and 2,240 lbs. avoirdupois (a long ton) in Great Britain. A metric ton is equal to 1,000 kilograms or about 2204.6 lbs. avoirdupois. As a measure of weight, the ton is used for most commodities handled in large quantities.

The ton is also a measure of capacity, especially in ships. The tonnage or carrying capacity of a ship is based upon the space available for carrying commodities and 40 cu. ft. is taken as one ton. In the displacement of a ship the ton is 35 cu. ft. The size of a ton for certain commodities varies as follows: for oak or ash timber, 40 cu. ft.; for earth or gravel, one cu. yd.; for wheat, 20 bu.; for lime, 40 bu.; for coke, 28 bu.; for Portland stone 16 cu. ft.; for salt 42 bu.

TONAWANDA, a river port and city in Erie Co., western New York, situated on the Niagara River at the western end of the state barge canal, opposite North Tonawanda and a few miles north of Buffalo. Bus lines, three railroads and lake, canal and river craft serve the city. It shares with North Tonawanda an airport and a splendid harbor from which a great quantity of white pine lumber is shipped every year. The traffic of Tonawanda harbor in 1929 was valued at \$4,084,390. There are many manufactures including hardware, musical instruments and office equipment. In 1929 the factory output reached approximately \$17,000,000; the retail trade amounted to \$4,954,886. The hydroelectric power is supplied by Niagara Falls. The village of Tonawanda was incorporated in 1854; it was chartered as a city in 1903. Pop. 1920, 10,068; 1930, 12,681.

STONE, in music, has two meanings: 1. a musical sound of determinate pitch; 2. an INTERVAL.

1. A musical tone differs from a noise in being produced by regular, rather than by irregular, pulsations of the air. Its PITCH is determined by the frequency of those pulsations, its volume by their amplitude, and its tone-color by OVERTONES or partials which are an important feature of acoustics.

2. In the modern scale of equal TEMPERAMENT, a tone, often called a whole tone or, technically, a major second, as from C to D, is defined as the square of the twelfth root of 2, or $\sqrt[12]{2^2}$, since the ratio for the octave is 2:1, and a half-tone or, technically, a minor second, as from C to D \flat , is defined as the twelfth root of 2. The whole tone, or interval from C to D, hence equals 1.122462; that is, in terms of vibration frequency, C:D::1:1.122462.

In JUST INTONATION the interval has two sizes, the larger one, called a major tone, being expressed by the ratio 8:9, while the smaller one, called a minor tone, is expressed by the ratio 9:10. The interval C—D is a major tone, the interval D—E is a minor tone. Thus, in terms of vibration frequency C:D::8:9, D:E::9:10. Together these two tones form the interval of the major third, C—E $\left(\frac{8}{9} \times \frac{9}{10} = \frac{72}{90} = \frac{4}{5}\right)$.

The Pythagorean scale, on the contrary, was based on the major tone yielding the Pythagorean major third $\frac{64}{81} \left(\frac{8}{9} \times \frac{8}{9} = \frac{64}{81}\right)$ an interval too sharp to be acoustically desirable and accordingly abandoned. See also COMMA.

W.P.

TONGA, or Friendly Islands, an archipelago of the South Pacific Ocean, lying southeast of Fiji Islands. They embrace an area of 385 sq. mi. and consist of three groups known as Tongatabu, Haapi and Vavnu. These islands are mostly of coral formation and have a fertile soil which produces a variety of fruits. Copra is the chief export. The islands are ruled by a native queen but have been under British protection since 1900. Nukualofa is the capital. Pop. in 1928 was 27,100.

TONGAS, one of the sub-tribes of the Tlingit, a North American Indian group belonging to the Kolutchan linguistic stock. Their original habitat at the mouth of Portland Canal, Alaska, has been abandoned for the modern town of Ketchikan, Alaska.

TONGUE AND DISEASES OF TONGUE.

The tongue is composed for the most part of muscles with finely divided fat among them. It is covered with a mucous membrane, and also contains serous glands. The surface of the tongue is roughened with minute elevations called papillae, some of which are furnished with taste-buds. The tongue is employed in speaking, tasting and eating.

In *geographical tongue*, also called eczema of the tongue, there is peeling off of the lining membrane of the tongue, which starts in one spot and spreads in the form of a ring. The center of the spot heals while the disorder spreads at the edges. The fusion of these rings gives the appearance to the tongue similar to that of a geographical map from which the name is derived.

The cause for the condition is not known. It is found in infants, children and adults. There are often digestive symptoms. The disorder may be transient, but there is a tendency to relapse. There are often no symptoms, but there may be slight itching. No effective treatment has yet been found. Mild mouth-washes are suggested.

There sometimes occur on the tongue white patches due to thickening of the superficial layers of the lining membrane. This disorder is known as *leucoplakia buccalis*. The patches may be smooth or cracked.

The exact cause of the formation of these patches is not known. Irritation from highly spiced foods, excessive use of tobacco and sharp-edged teeth are contributing factors.

There may be small raised white spots or diffuse patchy bluish-white thickening of the tissue. The spots may become *cancerous*. This is shown by ulceration, swelling or the formation of lumps or nodules in the patches.

The *patches* are resistant to treatment. All irritants should be avoided. X-ray treatments may be tried. Active local treatment is inadvisable because of the tendency for the patches to become cancerous.

Ulceration of the tongue may occur from injury by a sharp tooth, from infection in the mouth, from syphilis, tumor, and tuberculosis. The lining membrane may become inflamed in the course of various mouth infections. Thrush affects the tongue as well as the mucous membrane of the cheeks.

In the disorder known as *black* or *hairy tongue*, a black patch occurs on the center of the back of the tongue. The patch is due to prolongation of some of the papillae and the deposition of pigment. The nature and origin of the pigment is not known. The prolonged papillae may simulate hairs.

The cause for the disorder has not been found. Treatment is useless. The patch returns if it is scraped off, but often disappears spontaneously.

W. I. F.

TONIC, the first and the most important tone in the musical scale, gives its particular name to that scale of which it is the lowest element. Thus, the scale based on C is the C scale, the scale based on G is the G scale, C being the tonic in the scale of C, and so on. From the tonic are reckoned the next two most important tones, the **DOMINANT** and **SUB-DOMINANT**.

TONIC SOL-FAH, a system of indicating musical tones by means of syllables rather than by notes, the syllables being *Doh, Ray, Me, Fah, Sol, Lah, Te* and taken in the order just indicated to signify the successive steps of any diatonic scale. Thus, in the scale of C, *Doh* would be C, *Ray* would be D, and so on, while in the scale of G, *Doh* would be G, *Ray*, A, and so on. In other words, it is a movable-do system, *Doh* always corresponding with the key-note rather than with any note in particular. The system is said to have been invented by an Englishwoman, Sarah Ann Glover (1785-1867) of Norwich, although its roots are apparent in the much older system of sol-misation. A few years later John Curwen (1816-80), an English clergyman, improved the system, establishing the Tonic Sol-fa Association.

The value of such a system of nomenclature is open to debate. Although of some assistance to beginners, it is scarcely of any use in putting musical literature at the disposal of the masses; like artificial languages, it requires study that might profitably be spent elsewhere, and its manifest inferiority to staff notation makes its present-day survival fairly surprising.

TONKA BEAN (*Dipteryx odorata*), a large tree of the pea family yielding the fragrant seed known as tonka bean widely used in perfumery. The tree, which is a native of Guiana, grows 60 to 80 ft. high bearing a somewhat almond-like fruit containing a long seed covered with a shining black skin. Its delicious fragrance, resembling that of new mown hay, is due to the presence of coumarin.

TONKAWA, a group of North American Indian tribes forming the Tonkawan linguistic family. During most of the 18th and 19th centuries they lived in central Texas. Their scattered villages composed of skin tipis were moved frequently. They were a warlike people, despised by other Indians and whites for their disagreeable nature, inclination to thievery and reputation as man-eaters. They planted few crops and lived chiefly on buffalo and other game and wild fruits. In 1859 they were placed on a reservation in Oklahoma but in 1862 were driven to a vagabond existence as the result of a concerted attack by tribes with old scores to settle. In 1884 they were again given a reservation in Oklahoma.

TONKING, a protectorate of French Indo-China bounded on the north by China, on the east by the Gulf of Tonking, on the west by Laos and on the south by Annam; area 40,530 sq. mi. The region consists of the valley and delta of the Red River and its tributaries, especially the Song-bo. The main river valleys are separated by lofty spurs from the

Yunnanese plateau. Mining is important, especially coal, zinc, phosphates, tin and graphite. There are vast limestone quarries, and large quantities of cement are manufactured. The chief crop is rice but in contrast to Cambodia and Cochin China there is little opportunity for the expansion of rice cultivation owing to the limited areas of flat land. Other products are maize, sugar cane, arrowroot, tea, coffee and tobacco. There is a large production of raw silk, most of which is used in the native weaving industry and only the surplus is exported. The chief town is HANOI, the capital of Indo-China. The bulk of the foreign trade passes through HAIPHONG. The protectorate is governed by a French resident. Pop. 1926, 7,402,000, of whom over 7,000 were French.

TONNAGE AND POUNDAGE, in England, taxes of great constitutional importance in the Stuart period. Tonnage was a duty of 1s.6d. to 3s. on every tun of wine or beer, and poundage was a duty of 6d. to 1s. on every pound of dry goods, except staple commodities, imported or exported. In 1628 Charles I attempted to levy these taxes, which resulted in Parliament's PETITION OF RIGHT.

TONO-BUNGAY, a novel by H. G. WELLS; published 1907. A young man goes to London to reap the fruits of a pharmaceutical scholarship but, instead, falls in with the gigantic schemes of his clever uncle, who foists upon the world the patent medicine, Tono-Bungay. This plot gives Wells numerous opportunities for venting his ideas on economics and the business and social structure of modern life.

TÖNSBERG, a city of Norway, capital of the district of Vestfold. The chief industries are shipping, whaling and fishing in the Arctic regions. The Tönsberg Canal unites the city with the Oslo Fjord. Pop. 1930, 11,997.

TONSILLITIS, an inflammation of the tonsils. There are three kinds of tonsils: (a) The mass of lymphoid tissue on the base of the tongue known as the lingual tonsil, which sometimes becomes inflamed and causes considerable discomfort. (b) The so-called pharyngeal or "third" tonsil, commonly known as "ADENOIDS," which is also a mass of lymphoid tissue high up in the nasopharynx. This tissue is present at birth and in many children causes obstruction to breathing by blocking the posterior end of the nose. (c) Tonsils, properly so called, are the faucial tonsils present in the fauces or throat, between the two pillars of the soft palate. These tonsils have the same lining membrane as other portions of the throat, and contain deep pockets or crypts in which bacteria, food particles, or saliva, may accumulate. The tissue lying below the lining membrane contains blood vessels, lymphoid tissue, nerves, etc.

In acute tonsillitis, there is infection due to bacteria. These are usually streptococci, pneumococci, *micrococcus catarrhalis*. Infections may occur at any time of the year, but are more common in spring and winter. The disease is usually seen in children or young adults, but may also involve older individuals. Some acute contagious diseases are usually ushered in

by sore throat and acute tonsillitis, particularly SCARLET FEVER.

During an *acute* infection the tonsils are usually swollen and the lining membrane is quite red. High fever is usually present, particularly in children, and often the glands of the neck, especially those below the angle of the lower jaw, are swollen and tender to the touch. There is difficulty in swallowing and the patient is often prostrated. At times there is difficulty in opening the mouth, or even a change in the speech, due to swelling of the soft palate and the base of the tongue. An acute special form of tonsillitis is occasionally caused by a peculiar rod-shaped organism and a spiral-shaped one and is called Vincent's angina. This was common during the War and was then known as "trench mouth."

Complications, such as marked infections of the glands of the neck, the formation of an abscess about the tonsil known as "quinsy" sore throat, septicemia (actual blood poisoning), swelling of various joints, involvement of the heart or kidneys, etc., may occur.

A particularly virulent form of sore throat is occasionally caused by forms of streptococci. This illness may at times become epidemic and has been traced often to faulty and contaminated milk supply. Streptococcus carriers acting as dairy men infect the udders of cows and so pollute the milk.

Treatment usually consists in the use of hot gargles and the application of soothing medicaments to the throat. Many physicians use salicylates and give sedatives when pain is annoying.

Chronic tonsillitis usually results from repeated attacks of the acute variety, because of greater susceptibility in the individual. In chronic tonsillitis and tonsils becomes quite large, the glands of the neck are chronically swollen, and in some cases, cheesy, foul-smelling plugs may form in the pockets due to the decomposition of the masses of food, bacteria and dead cells from the lining membrane. Also there may be systemic disorders, such as RHEUMATIC FEVER, ARTHRITIS and changes in other parts of the body which may become permanent.

Treatment of chronic tonsillitis usually consists in the removal of the diseased tonsils, which is the only way to avoid future attacks and to clear systemic disorders. When definite damage has been done in the heart, kidneys, or joints, tonsillectomy does not restore the parts to normal conditions, though it may in many instances prevent further damage to these structures. Where there is foul breath due to the cheesy plugs already mentioned, the only successful treatment is the removal of the tonsils. R. So.

TONSILS, paired masses of lymphoid tissue situated at the entrance to the pharynx. Though there are three pairs of tonsils, of which the ADENOIDS are one pair, the term is generally applied to the palatine tonsils, lying imbedded between muscular columns on either side of the pharynx, at the side of the root of the tongue. Microscopically, they are composed of a number of narrow crypts, the thickened walls of which are occupied by lymphocytes (*see* BLOOD).

The normal tonsil should not project beyond the muscular pillars which enclose it. However, it is very frequently enlarged as a result of inflammation. The inflammation may be of a low grade and endure comparatively unnoticed for years, or it may be very acute and severe, and considerable pus to be produced, requiring drainage. Since there is no known function for the tonsil, and infected tonsils may lead to disease in other parts of the body, they should be removed. The operation is entirely safe.

TONTI, or **TONTY**, **HENRI DE** (c. 1650-c. 1703), explorer of the Mississippi Valley, associated with **LA SALLE**; known as the "man with the iron hand" from his having replaced an arm lost in battle with an artificial one of metal. He was born in Italy, and entered the military service of France, sailing with **La Salle** for Quebec in 1678. **La Salle's** lieutenant on the expedition to the Mississippi, **Tonti** left Fort Crèvecoeur, 1680, with a small party in search of a better site for a fort, was captured by the Indians, and in 1681 rejoined **La Salle** at Michilimackinac. After the voyage down the Mississippi **Tonti** was left in charge of Fort St. Louis and became very friendly with the Illinois Indians, with whom he lived at intervals until 1702. In 1686 he descended the Mississippi in fruitless search for **La Salle**, and in 1702 joined **Iberville's** colony in Louisiana. He died at Mobile, Ala., about 1703.

TONTO, the popular name for the Tulkepaia, a tribe of North American Indians belonging to the Yuma linguistic stock and believed to have sprung recently from a mixture of Yuma, Mohave and Yavapai. They claimed the region between the Colorado River and the country of the Yavapai in western Arizona. In 1873 they were placed on the Rio Verde Reservation and later removed to the San Carlos Reservation.

TONTO, a national monument under the administration of the Department of Agriculture, comprises about 640 acres in Gila Co., Arizona. The tract, which contains two ruins of cliff dwellings, was set aside as a government reservation Dec. 19, 1907. The dwellings were discovered in 1877. They are two and three stories high and built of adobe with supporting beams and the lintels of the windows made of red cypress hewn with stone axes. The lower floors are of clay, trodden hard. The monument is accessible from both the Apache Trail and the Roosevelt Highway. Globe, Ariz., on the Southern Pacific system, is the nearest railroad city.

TOOELE, a city in northern Utah, the county seat of Tooele Co., situated 35 mi. southwest of Salt Lake City. It is served by two railroads. The chief interest of the city are mining and smelting industries. The vicinity has salt and limestone deposits. Great Salt Lake Desert lies about 50 mi. west. Pop. 1920, 3,602; 1930, 5,135.

TOOL ALLOYS, steel and other alloys with properties fitting them for use in hand or machine tools. Tools, unlike structural steel members, are not employed to withstand static forces alone, but instead

are generally used in a manner wherein they lose edge or contour and their life depends therefore upon their resistance to wear and breakage. They require then the most carefully made steels, free from defects and non-uniformities. Tools are usually hardened by heat-treatment and for this purpose the higher carbon (.80% to 1.30%) steels are best suited.

Almost all tool steel is produced in the electric furnace, a small amount being melted in crucibles. Ingots of tool steel are often forged or pressed into billets which are subsequently rolled into standard bars. Such steel is then softened or annealed by suitable heating and slow cooling to permit easy shaping by machine tools. The tools are then hardened by quenching from 750°-1250° C. into water or oil and the excessive brittleness relieved by tempering at a moderate temperature, 150°-600° C.

Since dimension is all important in tools, the metal must be capable of precise machining and grinding. It must take a smooth surface on edged tools and have the peculiar property of retaining edge which implies some toughness and great hardness. The securing of this combination is now largely a precise science of steel-making and heat-treating. A large proportion of tool steel contains one per cent or more of chromium, manganese, tungsten, or mixtures of these in order to secure deep-hardening or wear resistance. Rapid machining of metal develops so much heat that hardened tool steel for lathe tools, etc., should be able to withstand 550° C. without much softening. This requirement is met by high speed steel with 18% tungsten and 4% chromium. Similar steels are used for hot dies, etc. Tool steels are more carefully made and inspected than structural steels even when of similar composition.

Recently, cast or sintered tools carrying large amounts of tungsten with carbon and cobalt have evidenced merit for special work. E. C. BA.

TOOLS, HAND, manually manipulated implements. They include such tools as carpenters' CHISELS, SAWS and similar tools, engravers' tools and many others. They also include tools used in turning wood or metal in a machine, if the tools are held in the hand, as is frequently the case. Hand tools are still widely used in many classes of work.

TOOLS, WOODWORKING. See WOODWORKING MACHINERY.

TOOTH POWDERS AND PASTE. See DENTAL PREPARATIONS.

TOOTHWORT, a name commonly given in America to a genus (*Dentaria*) of small perennial herbs of the mustard family with fleshy horizontal rootstocks, palmately divided leaves and white, rose-colored or purple flowers borne in small clusters. Among the best known species are the cut-leaved toothwort (*D. laciniata*), the two-leaved toothwort (*D. diphylla*), called also crinkleroot, used as a food plant by the Iroquois and other Indians, and the western toothwort or milkmaids (*D. integrifolia*) of the Pacific coast. In Great Britain the name toothwort is applied to a rose-colored, leafless plant (*Lathraea*

squamaria) of the broom-rape family, parasitic on the roots of trees.

TOPAZ, a name applied in former times to any yellow gem stone and especially to CHRYSOLITE. It is still given, in modified form, to gems of a yellow color, as oriental topaz to the yellow SAPPHIRE, and Scotch topaz, false topaz, or smoky topaz to yellow QUARTZ or citrine. Properly speaking, however, topaz means a gem stone usually of yellow color, quite hard, consisting of the basic silicate of aluminium, with fluorine. It crystallizes in the ORTHORHOMBIC SYSTEM, often being found as crystals, but also as granular or compact masses and as water-worn pebbles in PLACERS. Topaz occurs in GNEISSES, SCHISTS, GRANITES and PEGMATITES, and sometimes in veins with the tin ore, CASSITERITE.

Pure topaz is colorless and is used as a substitute for the DIAMOND. Unknown impurities impart wine-yellow, brown, gray, blue, green, violet and red colors. The yellow, precious topaz is most often used as a gem.

Green, blue and red topazes are found in Russia, sky-blue ones come from Ireland and Scotland, and Brazil is important for wine-yellow, blue, green and colorless stones. The Saxony and Cornwall tin mines provide good crystals. In the United States they are found in Utah, Colorado, California and New England. See also ACCESSORY MINERALS; MINERALOGY; ORE DEPOSITS; GEM STONES.

TOPEKA, the capital of Kansas, and the county seat of Shawnee Co., situated in the northeastern part of the state, on the Kansas River, about 66 mi. west of Kansas City. Transportation facilities include the Atchison, Topeka and Santa Fe, the Chicago, Rock Island and Pacific, the Union Pacific and the Missouri Pacific railroads, and bus lines. The city has a municipal airport and several parks. There are extensive and varied manufactures, their value in 1929 being about \$30,000,000; the retail trade in the same year amounted to \$42,581,194. Natural gas is piped to the city from southern Kansas and the Amarillo, Tex., field. Washburn College and the Topeka Industrial and Educational Institute for Negroes are located here.

The town was founded in 1854 by emigrants from Lawrence, Kan., and has considerable historical interest. The Topeka Constitution was framed here in 1855. Topeka was incorporated in 1857 and was made the state capital in 1861. Pop. 1920, 50,022; 1930, 64,120.

TOPELIUS, ZAKARIAS (1818-98), Swedish poet and novelist, was born near Nykarleby, Finland, Jan. 14, 1818. He studied at Helsingfors, where he afterwards made his home. For many years he was editor of *Helsingfors Tidningar*, and his earlier poems and stories were published in that paper. After he gave up his editorial work he was professor of history at the University of Helsingfors and finally Rector of that institution. Topelius's best known work is a series of novels entitled *The Surgeon's Stories*, in which he depicted 17th and 18th century life in

Sweden and Finland. He also wrote several volumes of poetry, a number of works on the history of Finland, and some plays, among the latter *The Princess of Cyprus*, which was produced at the opening of the Helsingfors theater in 1860. Topelius died at Helsingfors, Mar. 12, 1898.

TOPHET, in Biblical reference, a place or pyre in the Valley of Hinnom, or the valley itself, where human sacrifices were made. It later became a synonym for Gehenna and is probably associated with the Aramaic for place of fire. Tophet is mentioned in II Kings 23:10 and Jeremiah 7:31.

TOPINISH, a small North American Indian tribe speaking the Klickitat dialect of the Shahaptin linguistic stock. They live along the Topinish River, Yakima Reservation, Wash.

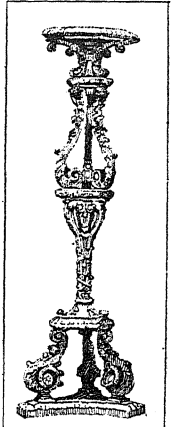
TOPOGRAPHY, the physical features of the land, natural and artificial, and the form of the land surface. These are depicted on a map by means of appropriate symbols. Surveyors sometimes apply the form "flat topography" to the horizontal location of cultural features, such as railways, highways, buildings and fences. The complete topographic map, however, shows the form of the surface by means of contour lines or by hachures. See also SURVEYING; MAPS AND MAPPING.

TOPSY, a fun-loving, mischievous young slave girl in Harriet Beecher Stowe's *UNCLE TOM'S CABIN*. She is most famous for her declaration that she had "just growed" without ever having had father or mother.

TORCHÈRE, a tall decorative stand for torch, candle, lamp or other light, such as a piano-lamp; generally made of some valuable material like bronze or marble. There are two principal types:

(1) A tall table with small top of any shape, and one central support branching, near the floor, into three scrolled and carved legs. The ornamentation consists of turning, or carving of human or animal figures, or of Chinese lattice-work, gilded, painted or japanned. The top may be inlaid or painted, or of polished marble.

(2) A "pedestal" or "term" form. The pedestal torchère is of massive construction, and was developed from the pedestal supporting the classic column. The term form was inspired by the boundary stones of antiquity, which often consisted of a human bust



COURTESY M. M. OF ART
TORCHÈRE OF THE
LOUIS XIV PERIOD



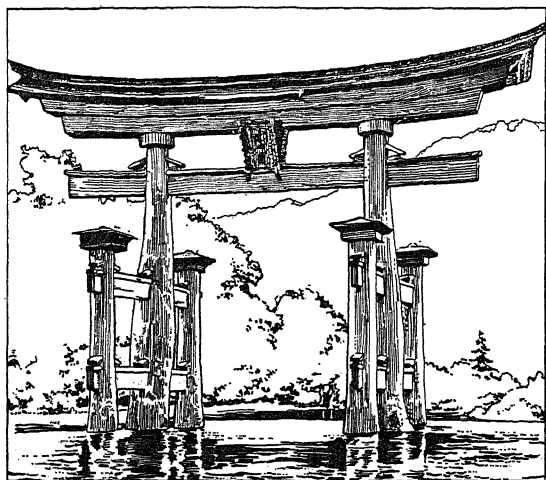
COURTESY M. M. OF ART
TORCHÈRE CARVED
OF WOOD
Louis XIV period

without arms surmounting a short inverted obelisk. The small table top was permanently balanced on the figure's head. The two most noted examples of this form are a winged child's head, gilded, dating from 1730, and an inlaid satinwood obelisk with a marble top, from the same century.

TORCH FLOWER, a name given to the **POKER PLANT**, a highly ornamental perennial of the lily family bearing a dense spike of scarlet and yellow flowers.

TORDESILLAS, TREATY OF, concluded in 1494 between John II of Portugal and Ferdinand and Isabella of Spain established a north and south line 370 leagues west of Cape Verde. Over all lands and discoveries to the west of this line the Spanish were to have dominion; over all lands to the east of it, the Portuguese. This treaty modified two bulls of Pope Alexander VI issued the previous year on the same subject.

TORII, a decorative Japanese gateway formed by two upright posts supporting a downward curving beam that projects on each side. Their subtlety of



TORII AT THE ENTRANCE TO MIYAJIMA TEMPLE, JAPAN

curvature and proportion often gives them an exquisite beauty. Torii are not only used as decorative gateways, but have great religious significance and are often set up as memorials.

TORNADO, a localized storm of great force and destructive power, usually traveling across the country in advance of a thunderstorm. It is of the whirlwind type and not a cyclone proper in that one of the essential characteristics of it is a vertical motion of the air, in addition to an extremely fast rotary motion, where the speed of the air currents has been estimated to equal that of a rifle bullet. In the center of the vortex the pressure is exceedingly low, with the result that when it passes close to houses, barns, etc., these may burst outward.

A completely developed tornado always possesses a tornado-cloud, a black funnel-shaped mass extending downward from the storm clouds above, the whole moving forward with a velocity of from 20 to 40

miles per hour. Owing to its small size, usually not more than a few hundred yards across, and its great speed, a tornado passes over any one place in less than a minute; but it may, in that short time bring complete destruction. Usually the length of its path, some 20 miles before its force is spent, is a record of continuous wreckage.

Occasionally the tornado cloud shows an irregular up and down motion, passing over one locality but descending upon the next one again with full destructive force. Tornadoes are usually accompanied by severe thunderstorms and a heavy fall of rain or hail. They occur most frequently in the Mississippi basin, where their path is usually from southwest to northeast, and in countries such as Australia and South Africa.

TORONTO, the capital and largest city of Ontario and the second city in size of Canada. With an area of 34 sq. mi., it is situated on ground gradually sloping from the harbor front on the northwestern shore of Lake Ontario to a crescent-shaped range of hills that lie in a northerly direction. The harbor is one of the most important on the Great Lakes, and is protected from the open waters of Lake Ontario by an island about 4 mi. in length lying about 2 mi. from the water front. The island has summer homes, a beautiful park and is the headquarters of the Royal Canadian Yacht Club. Since the completion of the Welland Ship Canal (*see* WELLAND CANAL) many new wharves, piers and quays have been erected on the harbor.

The city has a number of parks. Queen's Park, adjoining the university, has a large area, and High Park, near the lake shore, is beautifully planned. The ornamental buildings and educational centers include the University of Toronto, the provincial government buildings and the laboratory buildings of the Ontario Research Foundation. The university is one of the best equipped on the American continent and has the largest student enrollment in the British Empire. The Research Foundation was established to provide facilities for the investigation of problems concerning agricultural, industrial, mining and forest industries in Ontario. The city hall and the provincial museum are other noteworthy public buildings. The museum is the most complete in the Dominion and the variety of its collections is known throughout the continent. Hart House, one of the numerous buildings of the University of Toronto, was erected at a cost of about \$1,500,000 and is one of the finest university buildings in America. Other institutions of learning are McMaster College, the Central Technical School, with 5,000 students, and normal and model schools, medical and dental colleges. There are many churches in Toronto, some noted for their architectural beauty.

Industries include foundries, shipbuilding yards, grain handling houses, food packing plants and railway shops. Automobiles and agricultural implements are manufactured. Toronto is the publishing center of Canada. There are about 200 branches of in-

dustries from the United States in the city. Manufacturers have abundant hydroelectric power at low cost direct from Niagara Falls. Toronto is one of the chief live stock markets in Canada, with stock-yards covering an area of 35 acres.

As an air center, the city has commercial airports, flying fields, flying clubs, daily mail, passenger service south, east and west, a seaplane harbor and has the Canadian assembling and manufacturing plant of one of the world's largest airplane concerns.

The Canadian National Exhibition held each autumn in Toronto has an annual attendance of about 2,000,000 people. The Exhibition Park and buildings, valued at \$20,000,000, extend 1½ mi. along the lake. The Royal Winter Fair, a large indoor exposition held annually in November, has exhibits of live stock, horse jumping, foxes, poultry, dogs and agricultural products.

Toronto was founded as a French trading post, Fort Rouillé, in 1749. It was named York in 1794 and chosen as the provincial capital by the first governor of Upper Canada, Sir John G. Simcoe. Its present name, in Indian tongue meaning "place of meeting," was conferred in 1834, when it was incorporated as a city. The population in 1911 was 376,538; in 1921, 521,893; in 1931 the number of inhabitants, according to the official census, reached a total of 631,207. The large majority of the population of Toronto and environs is of English, Irish and Scottish descent.

TORONTO, a city on the eastern boundary of Ohio, in Jefferson Co., situated on the Ohio River, 9 mi. north of Steubenville. River craft and two railroads afford transportation. Gas, coal and clay are found in this region. The chief local industries are steel mill work and sewer pipe manufacture. Near by are pulp stone foundations useful in the making of paper. Toronto was laid out in 1818, being known then as Newburg Landing; it was incorporated in 1881 under the present name. Pop. 1920, 4,684; 1930, 7,044.

TORONTO, UNIVERSITY OF, a state coeducational university, situated at Toronto, Canada. It was founded in 1827 as King's College, opened in 1843, and renamed in 1849 the University of Toronto. In 1853 the university incorporated University College as its College of Arts. The present institution comprises University College, Victoria University, University of Trinity College, St. Michael's College, and Knox, Wycliffe and Emmanuel colleges. It has faculties of Arts, Applied Sciences and Engineering, Medicine, Education, Forestry, Household Science, Dentistry and Music; and departments of Public Health Nursing, Social Science and University Extension. The following colleges are affiliated with the university: Ontario Agricultural College, Royal College of Dental Surgeons, Ontario College of Pharmacy, Ontario Veterinary College, School of Practical Science, Ontario College of Art, Albert College, Alma College, Ontario Ladies' College and St. Hilda's College. The university has excellent laboratories, an

observatory, botanical gardens, and a library containing 263,056 volumes. It is supported partly from endowments and partly from grants by the Province of Ontario. The total value of assets in 1931 was \$16,174,850. In 1931-32 the university had 7,362 students and a faculty of 849 members. The chancellor was the Rt. Hon. Sir William Mulock, and the president, SIR ROBERT FALCONER.

TORPEDO BOAT, a vessel so built that it can carry, launch, and fire TORPEDOES or other naval appliances against the ships or other craft of an enemy's fleet. The appliances may be in addition to torpedoes proper, including underwater explosives such as mines, shells buried in shore or explosive charges attached to underwater spars capable of being fired by electrical devices. Years of experimentation were needed before a successful type of torpedo boat was perfected.

In the Civil War, torpedo boats were designed and used, but without material success. These, as a rule, were cigar-shaped, nearly submerged and carried only four or five men. Speed was seven knots, maximum. Developments in torpedo boats came fast. Thornycroft, Yarrow, Herreshoff and Ericsson were the leaders in improved design. Then the torpedo boat destroyer (*see* DESTROYERS) came into use and has steadily taken the place of the torpedo boat.

R. E. C.

TORPEDOES, NAVAL, cylindrical shaped objects 18 to 21 in. in diameter, launched from torpedo tubes on DESTROYERS, SUBMARINES or other classes of ships. Under automatic control they run at high speed submerged, striking enemy vessels and detonating their explosive warheads against the vessels on impact.

TORPEDO RAY, a family (*Torpedinidae*) of remarkable rays, known variously as electric rays, cramp-fishes and numbfishes. Although nowhere abundant, torpedo rays occur in all warm seas. They have a flattened, rather soft and limp body, which is rounded in front, a short, stout tail, and very smooth skin. On each side between the head and the breast fin there is a large electric organ, capable of imparting a severe shock to man and various other animals. By means of these electric organs torpedo rays are enabled to benumb their prey and also their enemies. Torpedoes live on or near the sea bottom and are ovoviviparous, their eggs being hatched internally. The Atlantic torpedo (*Tetranarce occidentalis*), found from Maine to Cuba, is blackish in color, usually from 2 to 5 ft. long, and sometimes weighs 200 lbs. The closely allied California torpedo (*Tetranarce californica*), which attains a length of 3 ft., is a rare species found in warm sandy bays on the California coast.

TORQUAY, a seaport and watering-place of Devonshire, England, situated upon terraced hills above Tor Bay on the English Channel, about 195 mi. southwest of London. Until the middle of the 19th century an unimportant fishing village, nevertheless Roman remains, the ruins of Tor Abbey (1196), the 13th century Spanish barn and remnants

of a 12th century chapel, attest its early existence. After the defeat of the Armada, Don Pedro's galley was towed into Tor Bay, and it was also the landing place of William of Orange in 1688. There are many handsome modern buildings and institutions, and the semi-tropical climate is excellent for bathing and boating. A terra-cotta manufacture prospers, together with the industry of marble-polishing. Pop. 1921, 39,110; 1931, 46,165.

TORQUE, the moment of a force to produce rotation. It depends both upon the magnitude of the force and the perpendicular distance between the line of action of the force and the axis about which the turning occurs. The moment of a force or a torque, L , is defined as the product of the force, and the perpendicular distance, r , between the axis of rotation and the line along which the force acts. Thus,

$$L = Fr$$

In a bicycle the torque applied to the crank hanger is the product of the weight of the rider and the perpendicular distance between the axis of rotation and the vertical line passing through the center of the pedal. At the top of the circle in which the pedal moves,

$$r = 0 \text{ and therefore } L = 0$$

L is a maximum when the pedal arm is in a horizontal position.

In the case of a **FORCE**, its distinguishing mark is that it produces or tends to produce a linear acceleration. Torque produces or tends to produce an angular acceleration. (See **VELOCITY**.) A torque is to rotatory motion what a force is to translatory motion (see **MECHANICS**).

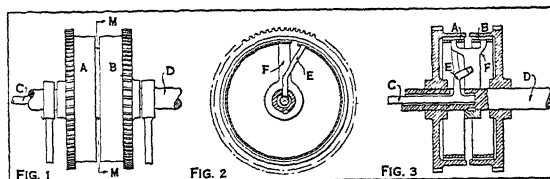
A **couple** is simply two equal torques acting in the same direction having equal arms and equal forces. Two equally strong men working on a capstan would illustrate a couple. S. R. W.

TORQUE AMPLIFIER, a mechanical device so designed that a small amount of power applied to the control shaft directs power sufficiently large to perform laborious operations. As applied to the steering of an automobile it multiplies a slight effort on the part of the driver sufficiently to control the heaviest truck. Amplifiers of this design have been made to develop from 10 to 50,000 times the power applied at the control.

The torque amplifier has two drums that are rotated by a motor or engine in opposite directions, each having a friction band that may be brought into contact with the drum by the control shaft. These friction bands have sockets in each end, one of which engages with studs on an arm connected to the work shaft while the socket on the other end engages an arm connected to the control shaft. If the control arm is moved it will expand the band in the drum moving in the direction in which the control shaft is moved, at the same time loosening the other friction band. In the case of steering mechanisms, a slight movement in the desired direction engages the friction bands which supply power for the real work of steering, the power being taken from the engine

in the case of an automobile or motor truck, or from a separate electric motor in other cases.

A simple form of the device is shown in Fig. 1, where two drums, A and B, are driven in opposite



TORQUE AMPLIFIER

Fig. 1, Simple torque amplifier; Fig. 2, section MM through Fig. 1; Fig. 3, longitudinal section through Fig. 1

directions by a motor that is not shown, through the gears indicated. The control shaft is at C and the work shaft at D. A sectional view through the center at MM, is seen in Fig. 2. Fig. 3 is a longitudinal section through both drums. The control shaft C goes through the center of the shaft and carries a forked control arm E that projects through the side of the work shaft and can turn through quite an angle. The work shaft also carries the work arm F. F. H. C.

TORQUEMADA, TOMAS DE (1420-98), first Inquisitor-General of Spain, was born at Valladolid in 1420 and joined the Dominican Order. As Inquisitor-General of the **INQUISITION**, an office he assumed in 1483, he soon became hated and feared for his cruelty to actual or supposed heretics. In 16 years he is said to have condemned 8,000 persons to the stake. Torquemada died in 1498.

TORRANCE, an industrial city in Los Angeles Co. in southern California; situated 16 mi. south of Los Angeles and served by the Santa Fé and Pacific Electric railroads. There are oil-fields nearby. The chief manufactures are steel products, oil tools and machinery, rubber and abalone shell novelties. Fruit, vegetables, alfalfa and poultry are raised in the vicinity. Pop. 1930, 7,271.

TORRENS SYSTEM, a mode of registering and conveying titles to land. It originated in Australia in 1858 at the instance of Sir Robert Torrens. Instead of recording deeds as in the prevailing American system the title is adjudicated by a land court and a certificate issued to the holder of the title. This certificate can be transferred and the title as shown by the registry in the land court is conclusive, a provision being made for indemnity of those whose interests may be wrongfully cut off through the action of the tribunal. Some of the United States have adopted this system concurrently with the prevailing system of recording deeds.

TORREON, a city of Mexico, situated on the Nazas River, in the state of Coahuila, 96 mi. from Durango City, at an altitude of 3,790 ft. above sea level. It lies in the rich Laguna section of the state, and is a thriving city, with cotton factories, flour mills, an iron foundry, large wholesale houses, important banks, and a few miles out, a huge smelter, to which

ores are shipped from distant mines. Torreon receives its power from Gomez Palacio, a neighboring town, with which it is connected by an electric railway. Bus service is also maintained to some of the nearby towns and to the smelter. Market gardening is carried on by a large colony of Chinese and cotton is grown extensively in the surrounding country, yielding abundantly in good seasons. The city was founded in 1887 on the site of an old ranch, *El Coyote*, and incorporated in 1907. Pop. 1930, 73,369.

TORRES VEDRAS, LINES OF, the great fortifications 25 miles north of Lisbon, to which the Duke of Wellington retreated in Oct. 1810 during the PENINSULAR WAR. The lines, three rows of earthworks strengthened with redouts, stretched 30 miles along the heights from the Tagus to the sea. The French laid siege for five months but could not force them.

TORREY, JOHN (1796-1873), American botanist, was born in New York City, Aug. 15, 1796. He studied botany privately under Amos Eaton, and from 1815 to 1818 studied medicine. In 1824 he became professor of chemistry and geology at the U.S. Military Academy, West Point, and two years later received the chairs of chemistry and botany at the College of Physicians and Surgeons, New York. Becoming State botanist in 1836, he devoted himself to the publication of his *Flora of North America*, aided by his student, the later famous botanist Asa GRAY. Torrey died in New York City, March 10, 1873.

TORRICELLI, EVANGELISTA (1608-47), Italian physicist and mathematician, was born probably at Pincaldoli, in the Romagna, Oct. 15, 1608. In 1627 he went to study in Rome, where he became acquainted with Galileo's dialogues, and where he himself wrote on the principles of motion. Going to Florence in 1614, he acted as assistant to Galileo during the last few months of the latter's life, and after his death was appointed mathematician in the service of the grand duke. His researches disclosed the existence of atmospheric pressure, and he constructed the first barometer, or Torricellian tube, as it was called after him. He also improved the telescopes of his time. He died at Florence, Oct. 25, 1647.

TORRID ZONE, a belt encircling the middle portion of the world, defined by the Tropic of Cancer on the north and the Tropic of Capricorn on the south, and comprising about two-fifths of the earth's surface. Its total area is distributed between ocean, 70,000,000 sq. mi., and land, 17,000,000 sq. mi. The latter figure represents approximately one-third of the total land area. Part of it is desert, part is covered by dense forests, all such regions being sparsely peopled; but large areas are fertile, very productive and support dense populations. In Java 30,000,000 people live in an area smaller than the State of Pennsylvania.

The tropical regions include, in the western hemisphere, part of Mexico, all of Central America and the islands to the east, or one-seventh of North Amer-

ica; and about three-fourths of South America. In the eastern hemisphere they include none of Europe but about one-fifth of Asia, with fully one-half of its population; three-fourths of Africa and two-thirds of its people; and about one-half of Australia and one-fourth of its people.

The conditions which distinguish this region from the ones on either side are a consistent uniformity of climate, little variation in the length of day and night, and little variation in temperatures throughout the year. The average range is 15° F. but in many places it is much less. At Bogotá, Colombia, the mean temperature of the coolest month is only 3° below that of the warmest, and at Buitenzorg, Java, the range is only 1.8°. Temperatures are consistently high, moderated only by altitude.

Such slight changes in climate have little influence on animal and plant life, and vegetation grows throughout the year where rainfall is sufficient. There is, however, an extreme variation in rainfall. Some places are always dry, some always rainy, some have alternate rainy and dry seasons. Distribution of moisture is controlled by the winds and topography. The shifting equatorial belt of calms has almost daily rainfall and is marked by a dense equatorial forest, bordered on either side by areas of grasslands, such as the Sudan in Africa, the llanos in Venezuela and the campos of Brazil. On either side of this belt the southeast and northeast trade winds blow. They are principally drying winds, and the interior lowlands in their path are frequently deserts, such as the Great Sandy Desert of Australia, the Kalahari Desert of South Africa, and the great Sahara. The east-facing coasts, however, which receive the trade winds directly from the ocean, have abundant rainfall and are characterized by tropical forests. Examples are the east coast of South America, the East and West Indies, northeastern Australia and southeast Africa.

The population and cities of the tropics are concentrated in the highland regions where moderate temperatures prevail. Bogotá at 4° N. lat. has an altitude of 8,630 ft. above sea level and a mean temperature, in its warmest month, of 58.6° F., while St. Louis in lat. 38° 37' has an average of 78°.

TORRINGTON, a city of northwestern Connecticut, in Litchfield Co., situated about 25 mi. west of Hartford on the Naugatuck River. Bus lines and the New Haven Railroad serve the city. Cary Field, a private landing field for airplanes, is three mi. away. Torrington is an industrial center. From early times when brass tea kettles were first made here, the manufacture of brass products has been the chief industry. Other important manufactures are woolen goods and electrical appliances. In 1929 the total factory output was approximately \$41,000,000; the retail trade amounted to \$11,694,460. The town (township) of Torrington was incorporated in 1740. The village was called Wolcottville after the family who built the mill in 1813. Later it became the village of Torrington, and was incorporated as a borough in 1887. In 1923 Torrington borough was made co-extensive with

the town, and chartered as a city. Pop. 1920, 20,623; 1930, 26,040.

TORSION. The application of a **TORQUE** to a body when one part is held, e.g., in the twisting of a rod, constitutes a torsion of that body. The twisting of one part of a body with respect to another, brings into play those forces which resist the **SHEAR** between one layer of atoms and another. The amount of torsion which can be applied to a propeller shaft depends upon the coefficient of rigidity (*see ELASTICITY*).

TORSION BALANCE, an instrument used in geophysical exploration for mineral deposits, as well as in gravitational studies of the earth's crust. It measures differences in the strength of gravity with extreme delicacy. It differs in this from the pendulum, which measures only the total strength of gravity, a quantity not measurable with the torsion balance. It consists of a bar suspended by a fine wire, called torsion wire. This bar bears a weight at one end which is balanced by a weight suspended from the other end. The difference in direction and strength of the gravitational pull on these two weights produces a twisting of the torsion wire. This is registered photographically by means of a beam of light reflected by a mirror mounted on the wire. *See also* **GEOPHYSICS**; **EÖTVÖS BALANCE**.

TORT, in law, a private wrong as distinguished from a public wrong or crime. In general, a person is liable for what he undertakes (that is, upon contract), to make restitution in case of unjust enrichment at the expense of another (quasi contract), for acts of aggression upon the person, property or advantageous relations of another, for injuries due to want of due care in some course of conduct which he is pursuing, and for failure to restrain at his peril certain dangerous agencies or enterprises which he maintains, or in which he is engaged. The last three categories in the common law are classified as torts. The Roman law distinguished delicts, that is, intentional aggressions, and quasi delicts, that is, cases where one was held liable as for a wrong without fault on his part. Some writers upon Anglo-American law would use quasi tort for those torts in which there is no intentional aggression.

TORTOISE, a popular name for land-living members of an order (*Chelonina*) of reptiles. The name may also be used for other chelonians; in this case species like terrapin are usually called fresh-water tortoises, and sea turtles, marine tortoises. All true tortoises are distinguished from their aquatic cousins by their large, dome-shaped back "shells" (carapaces), under which their heads, paws and tails can be fully withdrawn, and by their club-shaped feet. Like other chelonians they have beak-shaped jaws without teeth.

Most tortoises are found in the Old World; only three species live in the United States. They are the gopher tortoise (*Testudo polyphemus*) found from South Carolina through Texas, Agassiz's tortoise (*Testudo agassizi*) from Arizona and southern California, and Berlandier's tortoise (*Testudo berlandieri*) which lives in southern Texas and Mexico. They re-

semble each other in being colored brown, and in liking dry warm places where they dig burrows for houses. Some tortoises may live several hundred years, and certain species attain large size. A giant tortoise may have a shell over 4 ft. long.

TORTURE, THE. The desire to torture, some people maintain, is innate in every human breast. It has expressed itself in a variety of ways in the law of different peoples. Extreme torture is felt to be more typically oriental than occidental, as are other forms of fanaticism. When at their height, ancient Greece and Rome forbade the torturing of their citizens. Socrates, though forced to drink the hemlock, was not subjected to the torture; and the Apostle Paul, we know, was spared it on another memorable occasion. But Jesus of Nazareth was scourged; he could not claim Roman citizenship. Since despotism spread as the Empire grew larger and weaker, the common belief that torture was necessary to obtain the truth from slaves was extended to persons accused of treason (*lèse majesté*). Likewise, "torture was recognized as indispensable to all trials for sorcery and magic. In 358 A.D. an edict of the Emperor Constantius decreed that no dignity of birth or station should protect those accused of such offenses from its application in the severest form." It was stipulated, however, that it should be applied only in cases involving life and limb. Also, if the accuser failed to establish his charge he was himself liable to be examined under torture.

As to the early Germans, "their system of jurisprudence had grown up free from the contaminations of torture. . . . Except among the Visigoths it was unknown among the barbarians who founded the commonwealths of Europe." (The ordeals of hot water, red hot ploughshares, etc., cannot be regarded as torture in the stricter sense, but as means to obtain the judgment of God.) In the early Middle Ages, utterances of St. Augustine, Pope Gregory I and Pope Nicholas I intimate that the Church, too, was opposed to its use. It was laid down as an accepted rule of Canon Law, 1140, that no confession was to be extorted by torment. In the secular courts, moreover, it was apparently not a regular part of criminal procedure, but an arbitrary means employed occasionally to obtain proof. Whether the revival of Roman Law in the later Middle Ages actually involved a revival of legal torture is, therefore, not certain. Laws requiring its use are to be found in the Emperor Frederick II's codes, 1224-31. The secular courts employed it sparingly.

But, since heresy now threatened the unity of the Church, and imprisonment proved to be a slow and expensive means for breaking the resolution of suspected heretics, the Church developed the Inquisition. A bull of Pope Innocent IV, 1252, granted to inquisitors extraordinary powers, regularizing the application of torture. It was introduced, according to Beccaria, because of the belief in the flames of purgatory. Confessions were extorted by torture so severe that the unfortunates' only alternative was death, averred a papal committee for the investigation of the Inquisition in Southern France, 1306.

Joan of Arc was uncanny; therefore she was subjected to prolonged and inhuman torture to force her to confess her witchery. Ere long the German Dominicans' Handbook, the *Witchhammer*, 1486, urged more severe torture to exterminate these criminals believed to be the direst and growing more numerous every day. Luther and Calvin did likewise. Furthermore, the new imperial code's, 1532, prescription of torture to obtain confessions from suspected criminals spread it to regions in which it had been hitherto unknown. A multitude of other authorities increased its abuse immeasurably by holding that penalty of death for witchcraft need not depend on a concrete mischief, and that in cases of "accepted crimes," such as witchcraft, heresy, treason and counterfeiting, the accused might be tortured sooner and more rigorously than in lesser ones. German witch persecution in the later 16th and early 17th centuries was, consequently, marked by the employment of torture greater in variety and extent than that of the Roman or of the Spanish Inquisition. Spee affirms that robust men who have undergone it have assured him that no pain can be conceived so intense and unbearable. Farinacci, 1616, as well as Grevius, 1624, avers that more crimes were committed in the courts of that day than in the lairs of the robbers.

Methods of Torture. The great collections of instruments of torture at Nuremberg and The Hague bear out also Grevius's assertion that there were more varieties of torture than members of the human body. A cursory glance at them explains why so many of the accused plead guilty at the mere threat of torture. However, if the exhibition of these diabolical instruments failed to produce the confession desired, the executioner was ordered to apply them. In the first stage the thumb screws were screwed down, sometimes so hard that the hands were frightfully mangled. In the second stage the leg screws were adjusted and slowly tightened, in some cases until the blood spurted out and the flesh was crushed to a pulp. This excruciating pain was occasionally heightened by hammering on the leg screws with a large key. The third stage was the strappado; the prisoner's hands were bound behind him and fastened to a pulley which was repeatedly jerked up and let down suddenly. Heavy weights were sometimes suspended from the prisoner's feet to intensify this agony. As a result, the arms were frequently wrenched from the sockets and the ligaments torn. If he screamed while under the torture the prisoner was often gagged; a large metal pear was thrust into his mouth, or his face was bound with a leather muzzle.

In some courts the obdurate prisoner was also beaten with green switches. His feet were soaked in brine, and a goat was set to lick the soles, none the less excruciating agony because it is laughable! Tar and sulphur were sometimes sprinkled over his body, or hot oil or alcohol was poured over it, and then lighted with a burning feather. Candles were held to the armpits, soles of the feet, and to other parts of the body; or the prisoner was lacerated and burned with

red hot tongs. Wasps and crabs, and mice confined by a bowl, were applied to gnaw at his flesh. In some cases things unspeakable were forced down his throat, and in such quantities that his abdomen almost burst. In a mandate to the Prince-Bishop of Bamberg regarding the proceedings against his chancellor on the charge of witchcraft, the Imperial Court of Justice took occasion, 1628, to protest against "the torturing . . . and tormenting of prisoners with sleeplessness and highly salted foods to produce extreme thirst, and with such a variety of other torments that are prolonged until confessions are forced—or until all the members of the body are so crushed and mangled that the prisoners no longer resemble human beings."

Whether Galileo was actually tortured by the Roman Inquisition has not been settled beyond the shadow of a doubt. However, to be kept in suspense and repeatedly threatened, to be confronted by the horrible fate of a Giordano Bruno, to be subjected to the humiliation of recanting, to be cut off from his fellows and from those pursuits that were the very breath of his nostrils, these constituted to one of his sensibilities and aspirations a degree of torture more refined, probably, than any that instruments of iron could inflict.

Spread of Opposition. In the 16th century, the humanists Erasmus, Luis Vives, Montaigne and Dr. Weyer expressed their opposition to the torture. In the early 17th century, when its abuse was on the increase, other individuals attacked it more thoroughly. Among these were the Remonstrant pastor, Johannes Grevius, who wrote his *Tribunal Reformatum*, 1624, while in prison in Amsterdam, and the German Jesuit poet, Friedrich von Spee, whose *Cautio Criminalis*, 1631, was prompted by the confessions of multitudes of condemned witches on the eve of their execution. Fearlessly and eloquently these writers lay bare the horrors of the torture. They present case upon case from their own and others' experience to prove that it often extorts utterly absurd and false confessions, even from persons of exceptional strength and discretion. Through the efforts of these individuals the use of torture was restricted in not a few quarters. It was the work of Cesare Beccaria, *Traité des Délits et des Peines*, 1764, however, more than any other, which helped to bring about the abolition of the torture *by statute*. This was achieved in most states of Central and Western Europe before the French Revolution; in others, in the early 19th century.

English law did not recognize torture as a part of criminal procedure. However, solitary confinement, cold and hunger (*peine forte et dure*), and enforced sleeplessness were employed there to wring confessions from obdurate prisoners. The latter, known as the Marsiglian torture, was in many cases only a shade less excruciating than the drop, drop, drop of water on the prisoner's head, resorted to commonly in the Philippines. It, too, not infrequently drove the victim over the verge of insanity. These methods of procedure, though employed by English officials, were no more justifiable from the standpoint of law than is the "third

degree" as frequently administered by police officials in the United States at the present day. L. O. G.

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TORY, HENRY MARSHALL (1864-), Canadian educator, was born in Guysboro, N.S., Jan. 11, 1864. He studied at McGill University and Wesleyan Theological College, Montreal. In 1889 he entered the Methodist ministry but resigned in 1893 to join the faculty of McGill. He lectured here in mathematics until 1902 and was associate professor until 1908. From 1908-28 Tory was president of the University of Alberta. He published several textbooks on physics, and in 1927 became director of the National Research Laboratories of Canada.

TORY, the name borne from 1680 to 1832 by the English party now styled CONSERVATIVE. It was applied originally to the supporters of the Duke of York, Roman Catholic brother of Charles II, whom the Whigs wished to exclude from the throne. Discredited by participation in the Jacobite uprising in 1715, the Tories played a minor role in politics until the accession of George III in 1760. A quarter of a century later, led by the younger Pitt, they entered upon a long period of ascendancy. The excesses of the French Revolution intensified their distrust of radical or sudden change. The enfranchisement of the middle classes in 1832, which they strenuously opposed, kept them out of office for the greater part of the next generation. E. M. S.

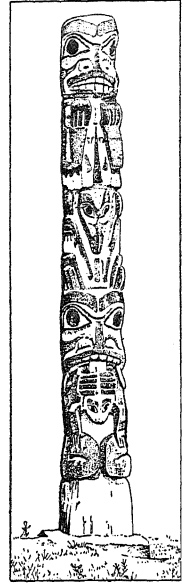
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TOSCA, an opera in three acts by GIACOMO PUCCINI, libretto based by Illica and Giacosa on the drama by Victorien Sardou; première, Rome and London, 1900, New York, 1901. It is numbered among the finest of Puccini's writings.

Mario Cavaradossi, a painter, is in love with the singer, Floria Tosca, but nevertheless has been having a love affair with one of his models. In a jealous rage, Tosca reveals to Scarpia, chief of police, the fact that Cavaradossi has befriended Angelotti, who has angered the papal authorities. Scarpia meanwhile falls in love himself with the beautiful singer, and by torturing Cavaradossi extracts from him the secret of Angelotti's hiding-place. Tosca, unable to bear the cries of her lover in an adjoining room, promises herself to Scarpia if he will relent. Accepting this compact, Scarpia orders that his victim be shot with blank cartridges, and thereupon demands that Tosca fulfill her agreement. He attempts to embrace her, receiving a knife in his heart for his endeavor. Meanwhile, his secret order that Cavaradossi be executed in earnest is put into effect, and in despair Tosca hurls herself into the Tiber.

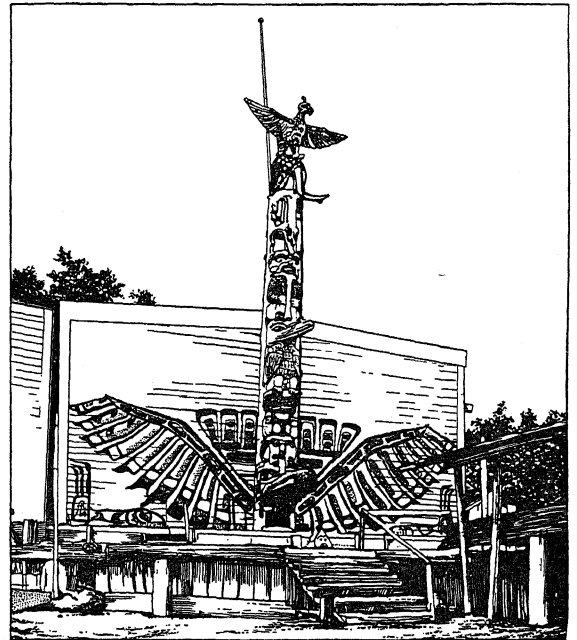
TOTEMISM, the belief, common among primitive peoples, that each kinship group has a particular re-

lationship with some animal, plant or natural phenomenon which is called by its Indian name, totem. The forms of totemism are so varied that anthropologists have given up trying to sum them up under a common head. In Australia the Kangaroo group believe themselves descended from the kangaroo. They are forbidden to eat kangaroos but they perform magical ceremonies to increase the supply of them for the other groups. In British Columbia the Eagle group believe that their first ancestor had a supernatural experience in which an eagle became his guardian. They carve eagles on their totem poles but do not object to killing them. In Africa kin groups often feel a religious objection to eating a certain animal or plant, but they do not bear its name. The result is that totemism appears to have originated, in some places, as a naming device, in others as a system of heraldry, and in others as a system of religious practices. It is almost always associated with a kinship group and this group often forbids marriage within itself but neither of these rules holds universally. Totemism in some form is found in widely separated sections of the world, in America, Australia, Melanesia, Africa and parts of Asia.



COURTESY NATIONAL PARK SERVICE. PHOTO E. W. MERRILL

ALASKAN TOTEM POLE



COURTESY AMER. MUS. OF NATL. HISTORY

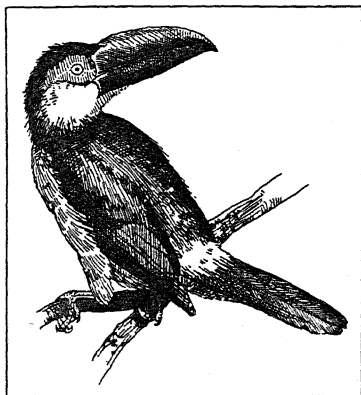
TOTEM POLE OF NORTHWEST COAST INDIAN HOUSE, ALERT BAY, BRITISH COLUMBIA

The lower head is raised to permit entrance

TOTONAC, an important Indian people of ancient Mexico who lived in the central portion of the present state of Vera Cruz. Their language, now spoken by approximately 75,000 descendants, is generally considered an independent stock though some authorities believe it to be related to MAYAN. These Indians claim to have built part of the now ruined city of Teotihuacan, about 30 miles northeast of Mexico City in the valley of Mexico, and to have migrated to their present territory about the year 700. Several centuries before the Spanish conquest they were overcome by the AZTEC peoples whom they equalled in cultural advancement. Totonacan art shows a strong Mayan influence. Their famous smiling or laughing heads are perhaps the first examples of native American clay modeling. "Stone collars" or "sacrificial yokes" found in the region are elaborately carved from single blocks of exceedingly hard stone. Their use is unknown.

TOTONICAPÁN, a city of GUATEMALA and capital of the department of the same name. It is situated on a high plateau about 61 mi. northwest of Guatemala City. Its chief industries are the manufacture of textiles, pottery and musical instruments of wood. Most of the inhabitants are *Quiché* Indians, who are skilled in making these instruments. Hot mineral springs dot the surrounding country. Earthquakes are frequent, one partially destroying the city in 1902. Pop. 1925, 30,888.

TOUCAN, a family (*Rhamphastidae*) of New World birds with enormous bills, allied to the woodpeckers. There are upward of 60 species found in



DRAWING BY GEORGE MIKSCH SUTTON

TOUCAN

wooded districts from southern Mexico to northern Argentina. They are rather large birds, 1 to 2 ft. long, with huge, very thin-walled, usually highly colored bills often nearly as long as the body, and brilliant black or green plumage varied with red, orange, blue or white. Toucans fly easily and gracefully and subsist chiefly upon fruits. When roosting they have the remarkable habit of throwing the tail upward and forward over the back and tucking the bill under the wing feathers. Like crows and magpies they are somewhat noisy and delight in worrying owls and other birds of prey. So far as known,

they nest in hollow trees, depositing pure white eggs. Being readily tamed, toucans make interesting pets. The widely known toco toucan (*Rhamphastos toco*), about 2 ft. long, has an orange bill and handsome black plumage marked with white, yellow and red.

TOUCH, one of the traditional five special senses denoting cutaneous sensations. These are now divided into three; namely, pressure, pain, and temperature. Pressure is the technical term for the popular term touch. Stimulation of the sense of touch gives rise to cutaneous sensations. On any given area of the skin will be found separate pressure, heat, cold and pain spots. Each of these has its characteristic local sign that distinguishes it from others. The pain spots are most numerous; next in number come the pressure spots. Sensations of temperature are due to the heat and cold spots, the former being more numerous than the latter. The predominance of pain spots can be accounted for by the biological function of pain. Not all areas of the skin are equally sensitive to touch. This may be discovered by touching different regions of the skin with two pointed objects placed closely together. By gradually moving them apart it will be found that the distance necessary for them to be felt as two varies with different parts of the body. It is common knowledge that the tips of the fingers are much more sensitive to touch than the middle of the back. Sensitivity varies from .04 to 2.64 inches. The brain center for touch and its kindred sensations is the post-Rolandic region of the cortex.

TOUCHSTONE. See CHALCEDONY.

TOULON, an important French naval station and headquarters of the Mediterranean fleet. Here, at the siege of Toulon by the English in 1793, NAPOLEON first distinguished himself. Toulon is a trading center. In addition to shipbuilding and activities of the arsenal and naval port it has fishing and vine-growing industries. Pop. 1931, 133,263.

TOULOUSE, an old city of southwestern France, historically both a cultural and commercial center. Important under the Gauls, Romans and Visigoths, it was an independent county from the 8th century until the 13th, when it was united to France, after the Albigensian Crusade. Toulouse is now the capital of the department of the Haute-Garonne. It has varied industries, including its national tobacco factory, and does a flourishing trade in wines and other products of the country. The Church of St. Sernin is the largest Romanesque church in France, having been exceeded in size only by the abbey church of Cluny, now destroyed. It was begun about the year 1075, and finished in its entirety before the end of the 12th century. The imposing nave, without clearstory, is flanked by double aisles, which are continued about the transept, and a high octagonal tower crowns the apse. Several other notable buildings and uncommonly rich museums make Toulouse an interesting city artistically. Its *Jeux Floraux*, a poets' tournament established in the 14th century, still awards coveted prizes. Pop. 1931, 194,564.

TOURACO, a name often applied to the plantain eaters, rather large, brightly colored birds of African forests, in imitation of their notes. See **PLANTAIN EATER**.

TOURCOING, a French textile city located a mile from the Belgian border. Tourcoing has flourishing silk, woolen, and cotton manufactures. With Roubaix it forms one of the most active industrial centers in France. Both towns have textile museums. Pop. 1931, 81,972.

TOURMALINE, a gem mineral which also occurs in less beautiful forms as a constituent of many **IGNEOUS** and **METAMORPHIC ROCKS**. It is unique in that a single crystal may exhibit different colors. One end may be green, for example, and the other red, or there may be intermediate zones of both shades. Some crystals show a core of red and an outer margin of green, as do those from Brazil, and others, as those from California, may be green inside and red outside. Other colors shown by tourmaline are brown, gray, blue, colorless and pitch black. Black and brown forms are usually opaque, and the lighter-colored ones, used as gems, are transparent. Tourmaline shows pleochroism. In composition it is a borosilicate and may contain fluorine, lithium, iron, magnesium and other elements. It crystallizes in long prisms of the **HEXAGONAL SYSTEM**, frequently showing a rounded triangular form in cross section, with vertically grooved sides.

Tourmaline occurs principally in **GNEISS**, **SCHIST** and **MARBLE**, but the gem varieties come from **PEGMATITES**. Madagascar provides tourmalines of many colors, yellow ones come from Ceylon. India, Burma, Siberia and Brazil also furnish gem tourmalines. In the United States, beautiful specimens are found in Maine, California and New York. See also **METAMORPHISM**; **GEM STONES**.

TOURNAI (Flemish, *Doornik*), capital of a district in the Belgian province of Hennegau. Tournai manufactures carpets and other textiles and carries on a brisk trade. It has wide streets and a fine Romanesque church, St. Brice, of the 11th century, near which the grave of the Frankish King Childerich was found. One of the oldest Belgian cities, it was the residence of the Merovingian kings, and in early medieval times was the center of Belgian art, and has been the seat of the Bishopric since 1146. Pop. 1930, 35,898.

TOURNEFORT, JOSEPH PITTON DE (1656-1708), French botanist, was born at Aix-en-Provence, June 5, 1656. He was educated for the church, but turned to science; made botanical collections, studied medicine at Montpellier and became professor of botany at the Jardin des Plantes in 1683. On royal order he conducted botanical expeditions to western Europe and to the Levant. His principal writing, *Institutiones rei herbariae*, 1700, stands as one of the most thorough pre-Linnean attempts at systematic botanical classification. He died at Paris, Dec. 28, 1708.

TOURNEUR, CYRIL (c. 1575-1626), English poet and dramatist, is supposed to have been the son

of Richard Tourneur, Governor of the Brill in Holland. He published his poem, *The Transformed Metamorphosis*, a cloudy piece of metaphysics, in 1600. Only two plays of his are extant: *The Revenger's Tragedy*, 1607, and *The Atheist's Tragedy*, 1611. A third, *The Nobleman*, licensed in 1612, is lost. Tourneur probably spent much of his life in the army of the Netherlands. He was secretary to the Cadiz expedition, 1625, which was disbanded in Kinsale, Ireland, and died soon after in poverty, Feb. 28, 1626.

TOURO, JUDAH (1775-1854), American Jewish philanthropist, was born at Newport, R.I., in 1775. In 1802, one year before France ceded the Louisiana Territory to the United States, Touro left his native city and settled in New Orleans, the first Jew to do so. From a small storekeeper he soon became a leading merchant and financier, and was noted as a pioneer philanthropist. He was especially well-known for his staunch patriotism. At the time of Andrew Jackson's defense of New Orleans in the War of 1812 Touro became a private in the American army and was severely wounded in 1815.

During the course of his life he contributed liberally to many social and patriotic causes, as well as to various charitable and philanthropic institutions in Boston, New Orleans and Newport. In his will he left a considerable sum of money for the erection of almshouses for the pious Jews of Jerusalem, appointing Sir Moses Montefiore the trustee of this fund. His will, too, divided large sums of money among both Jewish and non-Jewish charities of his native and adopted city, both of which commemorated him by naming streets after him. He died at New Orleans, La., in 1854, and was buried at Newport, in the old Jewish cemetery. A. SH.

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TOURS, a city on the Loire, 145 mi. southwest of Paris, formerly the capital of the province of Touraine, now capital of the department of Indre-et-Loire. An attractive city, with many interesting buildings, Tours is an important tourist center, especially for visits to the Loire chateaux. It has a prosperous trade in wines and other neighborhood products, and its printing industry is famous. The battle which stopped the Moors' advance in Europe was fought near Tours in 732. Balzac was born here in 1799. Pop. 1931, 78,767.

The Cathedral of St. Gatien, begun in the 13th century and completed in the 16th, shows stages in the development of architecture from Gothic to Renaissance, and in its famous west front, 1426-1547, the two styles are combined. The most beautiful feature of the church is its collection of stained glass. This represents the various epochs of its construction, and, after those of Chartres and Bourges, ranks among the finest in France. The rich Renaissance tomb of the sons of Charles VIII and Anne of Brittany, 1500-1506, is in a transept chapel.

TOURS, or POITIERS, BATTLE OF, one of the decisive battles of the world. It was fought in 732 between the Franks under CHARLES MARTEL and the Moors under Abd-ar-Rahman. Since 711 the Moslems had been advancing through Spain and southern Gaul, taking advantage of the weakness of the Visigoths in Spain (*see* GORHS) and the feud between Charles Martel and Eudo of Aquitaine in France. After defeating Eudo severely at Bordeaux and taking Poitiers, they pressed on toward the town of Tours. Near Poitiers the Franks, augmented by Eudo's forces, met them in Oct. 732. After a seven days' pause, the battle began and continued until night set in. Abd-ar-Rahman fell on the field, and the Arabs, having suffered great losses, evacuated their camp during the night, leaving the Franks victorious. The battle was important in that it turned back the wave of Moslem invasion which threatened to sweep over Europe and resulted in the restriction of the Moorish influence in Europe to the Iberian peninsula.

TOUSSAINT L'OUVERTURE, FRANÇOIS DOMINIQUE (1743-1803), Haitian statesman and soldier, was born near Cape Francois in 1743 of African slave parents. During the insurrection of 1791-92 he rose to prominence as a leader of his race and after the emancipation of the slaves was appointed by the French Directory chief of the army in San Domingo in 1796. On his own initiative he extended his authority to include the entire island and proved an able and just governor. When Napoleon in 1801 sought to reestablish slavery, Toussaint opposed him and was treacherously seized and taken to France, where he died in prison near Besancon, Apr. 27, 1803.

TOUT, THOMAS FREDERICK (1855-1929), British historian, was born in London, Sept. 28, 1855. He was educated at Oxford, and was a fellow of Pembroke College, Oxford (1883-90). He was professor of history at St. David's College, Lampeter (1881-90), and professor of history at Manchester University (1890-1925), where he built up a notable historical school. He was elected a fellow of the British Academy (1911) and president of the Royal Historical Society (1925). His most notable work is *Chapters in the Administrative History of Medieval England* (1920). Other works are *Empire and Papacy* (1898) and *France and England: their Relations in the Middle Ages and Now* (1922). Died in London, Oct. 23, 1929.

TOWER, THE, a group of historically famous buildings in London, on the north bank of the Thames, forming an irregular hexagon about 12 acres in area, surrounded by a double wall and a moat, now dry. The most famous of the buildings, the White Tower, with 16 ft. walls and solid masonry, was built about 1078 by Gundulf, Bishop of Rochester, and has served as a fortress, the castle and court of the Plantagenet kings, a state prison, and is now used as an armory. Of the remaining 13 towers, the most noteworthy are perhaps the Bloody Tower and Wakefield Tower, where the royal jewels are stored. The Norman Chapel of St. John and the 12th century

Chapel of St. Peter Ad Vincula are also here. Among the countless persons imprisoned in the Tower was Sir Walter Raleigh; and of the many who were put to death there were the "Little Princes," Anne Boleyn, Catherine Howard, Lady Jane Grey, and Sir Thomas More.

TOWER BRIDGE, THE, in London, England, a drawbridge crossing the Thames below THE TOWER. It was built in 1886-94 from designs by Sir John Wolfe-Barry and Sir Horace Jones, at a cost of about \$4,000,000. It is half a mile long, and consists of a carriage-way 29½ ft. above the water and a footway 142 ft. above the water. Its central span is equipped with twin bascules or drawbridges, which may be raised in 1½ minutes; these are borne by two towers connected with the banks by permanent spans.

TOWER EXCAVATORS. *See* DRAGLINE EXCAVATORS.

TOWERS AND SPIRES. A tower is roughly any building whose most important dimension is its height; a spire is a pyramidal or conical roof over a spire. The origins of tower building are lost in the prehistoric past; in very primitive times the desire for height for places of worship was common, and the ZIGGURAT of the Mesopotamian valley, of which the biblical Tower of Babel is a legendary reminiscence, was merely a developed expression of this feeling. It is possible, too, that a largely unconscious phallic symbolism is present in the delight, so universal, in towers. There is another more practical reason behind tower building, the military fact that prior to the discovery and wide use of gunpowder, a force in a high position had great tactical advantages over one placed lower; all the military towers of castles and city walls had their origin in this.

Military Towers. Towers as essential features in fortifications are found from an early date in Mesopotamia; from there they seem to have been copied in Egypt and elsewhere. The Greeks used them little; but the Romans realized their value and developed tower design to a high point in city and camp walls. Most Roman walls from the Imperial period have battlemented towers, and the Romans especially developed the idea of the tower protected gate. Another classic use of the tower was as a lighthouse, or *pharos*. During the Dark Ages the Moslem world preserved and developed further Roman and Byzantine tower types; the source of much Romanesque and Gothic fortification is probably to be sought in the East. With the 13th century, the importance of the tower as an integral part of castle and town wall design was recognized all over Europe, and the careful placing and arrangement of the towers was an important part of military architecture. It was usually the aim to make each tower a possible independent fortress capable of defense even if the wall on either side was captured. The climax of this development is to be found in the great tower-like keeps or donjons which were the strongest portions of every castle. (*See* CASTLE AND CHATEAU.) The Far East, also, has a similar military development of the tower form, and

the great projecting square towers, often crowned with rich garrison buildings, are an impressive feature of every Chinese city wall, as well as of the Great Wall of China.

Religious Towers. Since the classic world used non-military towers little, the parentage of the Christian church tower is veiled. It is, however, significant that the great mosque of Samarra, 846-852, has a large minaret, round in plan with a spiral ramp leading up to its top, in a manner not unlike a rounded ziggurat. A similar form, though square, was used slightly later in the mosque of Ibn Tulun in Cairo. It is possible that when bells came into common use in Europe, probably in the 9th century, pilgrims' memories of Moslem minarets, or Syrian workmen, may have played a part in the choice of a tower form as a place in which to hang the bells.

At first the CAMPANILE was very simple; not until the 11th century was much attempt at decoration made. Romanesque France and Germany gave the form its greatest free development, especially in the 12th century, trying various treatments, either by means of recessed stages, as at Le Puy-en-Vélay and St. Sernin in Toulouse; by massing together several richly stepped openings, as in Auvergne, or by accenting vertical buttresses, as in Normandy and Germany.

Spires. It was in this search for a beautiful tower top that spires first made their appearance. The simple square pyramid, either of wood covered with tile or slate, or of stone, is common; occasionally, as in Aquitaine, conical forms carved with scallops are found. The Rhenish architects sought to vary the pyramid by topping the tower sides with gables whose slopes determined the spire, and by using octagonal pyramids with broaches or diagonal connecting planes at the corners. Romanesque towers are at various points of the church building. The central tower was common in southern France; the Cluniac abbeys and Norman examples had paired western towers as well, and the Germans often had two at each end.

Out of all these Romanesque experiments a type gradually evolved in which a square base grew lighter as it rose, with heavy buttresses decorating the corners, and large, rich openings near the top. This base was crowned with a pyramid, usually octagonal, and the corners between the square and octagon were filled with little pinnacles. This type is common in England, France and Italy. The highest development of this type coincided with the birth of the Gothic style. Its most perfect example is probably the early tower of Chartres Cathedral; another superb example is the central tower of Salisbury.

The remaining history of the Gothic spire consists in the constant improvement and refinement of this basic type. Buttress shapes were diversified, pinnacles and finials multiplied, and crockets added on the edges of the stone spire. The 15th century produced one striking new invention, the spire whose sides are of pierced traceried stone, giving the lacelike richness of Freiburg and Regensburg. This invention, a Ger-

man one, was also copied in Spain. Many rich Gothic towers were never designed to have spires, especially in the late period in France and England; the requisite richness at the top being given by openwork parapets and rich buttress finials.

The Orient. The Moslem minarets were remarkable developments of tower building. Each style created its own minaret form; they vary from the slim cylinders of Turkey and Persia, to the heavy square towers of north Africa and Spain. Indian minarets generally follow Persian prototypes; but the early enormous minaret of the Kutub mosque at Delhi is unique in its large size and rich molding. Tower forms are common also in various Hindu temples, where they are used as gates and over the sanctuary.

See CAMPANILE; GOTHIC ARCHITECTURE; MOHAMMEDAN ARCHITECTURE. T. F. H.

TOWHEE, a genus (*Pipilo*) of small active song birds of the finch family (*Fringillidae*), several species of which occur in the United States and Canada. The common towhee or chewink (*P. erythrophthalmus*), of eastern North America, breeds from Maine to Saskatchewan and southward to Georgia and Kansas and winters chiefly in the southern states. It is about 8 in. long, black above and white below, with chestnut sides and a white-tipped tail. The towhee, which commonly frequents thickets, scratching among the dead leaves and feeding chiefly on seeds and insects, is a remarkably energetic bird with a vigorous ringing song. In a well-lined nest, on or near the ground, it lays four or five finely speckled white eggs.

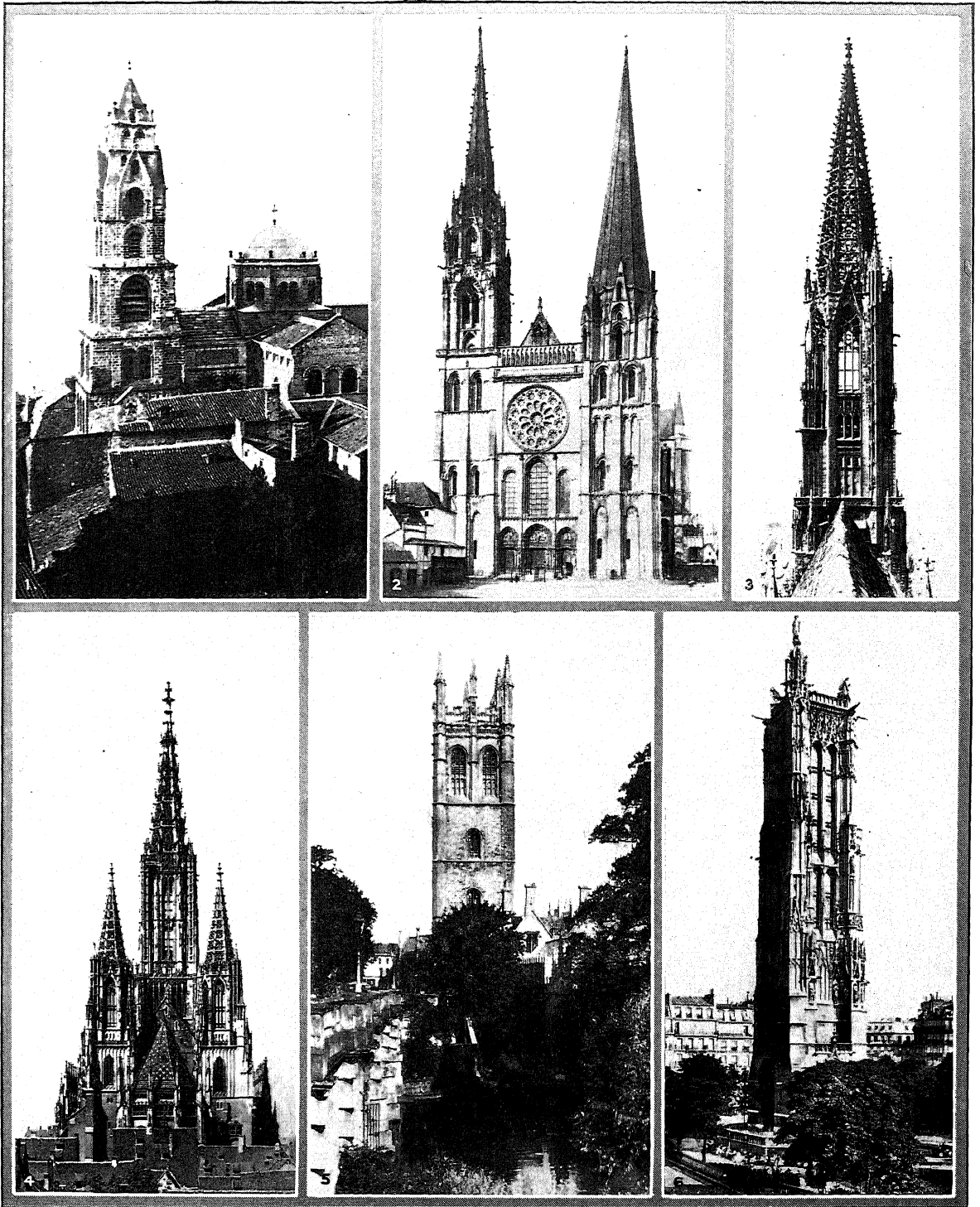
In the western states several other species occur, more or less resembling the eastern towhee in size, color and habits. Among these are the California towhee (*P. fuscus crissalis*), the canyon towhee (*P. fuscus mesoleucus*) and the green-tailed towhee (*Oberholseria chlorura*).

TOWN, the generic term for any group of houses from city to hamlet. In some parts of the United States it is used to mean an incorporated place larger than a village but not so large as a city. In New England the town is an important rural unit endowed with broad powers and governed by a town-meeting. Frequently the term is used synonymously with TOWNSHIP.

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TOWN AND CITY PLANNING, broadly speaking, provides for the future growth of a city so that it may function effectively; this involves the consideration of beauty, comfort and health; the efficient working of its business and industries; as well as transportation problems. In the carrying out of this study, three kinds of city planning should be noted: 1. That in which the entire city is new and consequently there are no fixed conditions limiting the general plan; 2. That which concerns the modification of an old city in which conditions are largely fixed and where changes result in heavy property damage; and 3. The layout of a new portion of an existing city.

TOWERS AND SPIRES



TOWERS AND SPIRES OF ENGLAND, FRANCE AND GERMANY

1. Tower of the Cathedral of Notre Dame, Le Puy, France. 12th century Romanesque. 2. West façade of the Cathedral of Notre Dame, Chartres, France. The south tower (right) dates from the end of the 12th century, and the spire added to the north tower from 1506-13. 3. Gothic tower of the

Cathedral (Minster) of Freiburg, Germany. 4. Late Gothic towers of the Münster of Ulm, Germany. 5. Magdalen Tower, Oxford, England, 1492-1505, a fine example of Perpendicular Gothic architecture. 6. Flamboyant Gothic square tower of St. Jacques, Paris, 1508-22.

Among the special problems which have to be studied are: 1. Street layout, including systems of arterial streets and transportation lines connecting different parts of the city, or connecting the city itself with other centers; 2. Housing problems; 3. Recreation centers; 4. Factories; 5. Markets; 6. Parks and amusement centers, with connecting drives and boulevards; 7. Waterfront development; 8. Water supply and sanitation; 9. Public buildings and semi-public buildings; and 10. Architectural problems.

Garden cities, so-called, are cities laid out with the view of preventing congestion in the industrial centers and providing, from the beginning, ample garden and park space. The central garden, with surrounding zones of public buildings, parks, and recreation fields, forms the nucleus. Outside this is a zone of shopping districts; next come residential zones; then finally the manufacturing districts, with transportation lines encircling the whole.

In other plans an attempt has been made to separate the vehicular traffic from pedestrian lines of traffic by having the street layout such that, by means of underpasses, persons may walk about the entire city, especially the park system, without crossing busy streets at grade; also the vehicular traffic may circulate freely to all parts of the city without delays. The main thoroughfares are crossed by but few streets so that traffic delays are minimized. G. L. H.

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TOWNSHEND ACTS, May 1767, a series of acts of Parliament for the collection of revenue in the American colonies, which rekindled the antagonism of the colonists. Sponsored by Charles Townshend, Chancellor of the Exchequer, the measures suspended the New York assembly until it should comply with the Bill of Rights Act (*see* INTOLERABLE ACTS), established a board of commissioners in America with extensive powers to administer the trade acts, and laid certain import duties: 4s. 8d. per cwt. on glass; 2s. per cwt. on painters' colors and red and white lead; 3d. per pound on tea, and duties on 65 kinds of paper ranging from 12s. per ream on "imperial fine" to 3d. for "small ordinary brown." New and stringent regulations were made to secure full information as to the progress of the voyage of any vessel entering a colonial port; and WRITS OF ASSISTANCE were formally legalized. Drawbacks on English export duties were granted to allow the East India Co. to sell tea in America below the price of smuggled tea. The revenues raised were to be used in giving the Crown complete control of the colonial governors and judges. Pamphlets declaring the legislation unconstitutional, committees of correspondence, and NON-IMPORTATION AGREEMENTS appeared as manifestations of resentment in the colonies.

TOWNSHIP, a division in the public land system of the United States, six miles square and containing 36 sections. Its boundaries run north and south, east and west. Also, a unit of local government in Pennsylvania, New Jersey, and most of the states west of

the Alleghenies—usually coterminous with the "Congressional" township described above. In certain states it possessed active powers of self-government, now rapidly disappearing. In others it is only a district for electing justices of the peace and constables.

TOWNSVILLE, a seaport of Queensland, Australia, situated on Cleveland Bay, 750 mi. north of Brisbane. The city, built on both banks of Ross Creek near its mouth, has excellent harbor facilities and is the second most important port of Queensland. Townsville is the natural outlet for the products of a wide region and is a progressive city. Among the more important industries are brewing and flour milling. Est. pop. 1929, 31,300.

TOXICOLOGY. Poisons are classified into three groups—(1) those which act by attacking the gastrointestinal canal, (2) those which attack the central nervous system, and (3) those which depress the nerves and circulatory systems. The first group includes acids, alkalis and irritant metals. The second group, which affects the nervous system, includes drugs like atropine, caffeine, cocaine, hyoscin, strychnine and volatile oils. The third group includes all drugs that are used in the treatment of diseases of the heart, coal-tar products, cyanides, hypnotics, narcotic drugs, nicotine, and all drugs that contain phenol or carbolic acid.

Such acids as hydrochloric acid and sulphuric acid burn or irritate the tissues with which they come in contact. Similar results are brought about by such caustics as lye, and also by astringent metals, such as lead, iron, aluminum, copper, zinc and silver. When such substances are taken into the body, they produce irritation and corrosion of the mouth, the throat and esophagus and the stomach, following which there is pain, vomiting and diarrhea. At first the person affected vomits the poison and the contents of the stomach, and then, according to the amount of damage done, mucus and blood. The person is likely to have some symptoms of shock due to the effects on the heart of the damage to the stomach. The symptoms of shock are collapse and a rapid, weak heart, shortness of breath, a clammy skin, cold perspiration and gradually failing of the pulse.

The treatment of poisoning by acids, alkalis or corrosive metals includes the giving of doses of warm drinks containing the antidote, if there is one, and also the giving of such materials as milk, white of egg and flax-seed infusions to prevent continuous action of the poison on the lining of the stomach. For corrosive acids, the most convenient antidote usually available is a solution of soap.

The collapse is treated by rest, heat and stimulating drugs which can be supplied only by a physician. In the absence of such stimulants, strong black coffee is useful. This may be given by injection into the rectum, since it is difficult for the patient to retain anything given by mouth. If the poison has been severe, rest in bed for weeks may be necessary.

If the person has been poisoned by some of the drugs that attack the central nervous system, the im-

mediate symptoms are pain, nausea and vomiting, cerebral excitement, rapid heart, rapid breathing and flushing of the face. Frequent after-symptoms are purging, delirium, convulsions, unconsciousness, and failure of the circulation. The ultimate effects on the kidneys may be serious.

The treatment is to give an antidote, if there is one, and to give an emetic in order to produce vomiting and thus to get rid of the material in the stomach. It is also desirable to wash out the stomach by means of the stomach tube, if vomiting cannot be brought about. Since these poisons are stimulants of the nervous system, it is customary to administer sedatives, such as bromides and chloral. In case of failure of the heart, stimulants of the circulation may be supplied.

In the third class of poisons, the effects are shown promptly both on the circulation and on the nervous system. The first aid treatment should be of the same character. See also ANTIDOTES. M. F.

TOYNBEE, ARNOLD (1852-83), British economist and social reformer, was born at London, Aug. 23, 1852. After graduation from Balliol College, Oxford, he began the study of economics and economic history, which led to his interest in practical social reform. He was a lecturer and tutor at Oxford, delivered addresses on economics in English industrial centers and engaged in welfare work among the poor in the Whitechapel district of London. His keen intellect, zeal and sincerity made a deep impress upon social work and social ideals of his time. After his death his name was appropriately given to Toynbee Hall, the first London social settlement, which proved a model for many later establishments. His writings were published in 1884 in a collection entitled *The Industrial Revolution*. He died at Wimbledon, Mar. 9, 1883.

TOYNBEE, PAGET (1855-1932), English scholar and authority on DANTE, was born at Wimbledon, Jan. 20, 1855. He was educated at Balliol College, Oxford, and was a private tutor from 1878 to 1892. During this time he became interested in the study of Dante, and later gained wide recognition as one of the leading authorities on the Italian poet. Among his works are *Critical Text of the "Divina Commedia,"* 1900, *Life of Dante*, 4th ed. 1910, *Dante Studies*, 1921, and several books on HORACE WALPOLE, which include *Horace Walpole's Reminiscences*, 1924, and *Strawberry Hill Accounts*, 1927. Toynbee died at Burnham, Buckinghamshire, May 15, 1932.

TOYON, the American-Spanish name for a beautiful evergreen shrub, native to the Pacific Coast, bearing highly ornamental red berries. See CHRISTMAS BERRY.

TRABZON or **TREBIZOND**, a city of Turkey in Asia Minor, situated at the east end of the Black Sea, about 570 mi. from Constantinople. Built on a plateau between two parallel valleys and inclosed by Byzantine walls it has narrow streets, many gardens, churches and mosques, some of the latter believed to be on the sites of Byzantine churches. An old citadel

still stands high above the rest of the city. The harbor is an open one, but for centuries Trabzon, on account of its advantageous position, has been the principal port for the transit from Persia to Europe. Founded by Greeks in the 7th century B.C. and called Trapezus by them, the city soon rose to a flourishing state. When the Crusaders occupied Constantinople in 1204, Alexis Comnenus established the Empire of Trebizond which lasted until 1461 when Mohammed II overthrew it. The Comneni family were famous for their beauty and princesses of the house were sought in marriage by Christian and Mohammedan rulers. Patrons of art and patrons of learning, the splendor of their palaces was widely known. During the World War the Russian fleet bombarded Trabzon repeatedly, and after a combined attack of the fleet and land forces the Russians occupied it in 1916. Silk, wool, linen and filigree are the principal articles of trade and export, and weaving, tanning and dyeing are carried on. Pop. 1927, 60,975.

TRACERY, the ornamentation of a structural opening or panel by inserting or building in it a plate or surface of material decoratively pierced, or a decorative pattern of straight and curved bars; also, any decorative pattern based on tracery forms. More loosely, the word is used for any intricate line pattern. The term is used most commonly in connection with the decorative subdivision of windows in the Gothic styles. Wall tracery is the decoration of walls, panels, or surfaces with forms first developed for window tracery. It was especially common in the later Gothic period. Plate tracery is that in which decorative holes

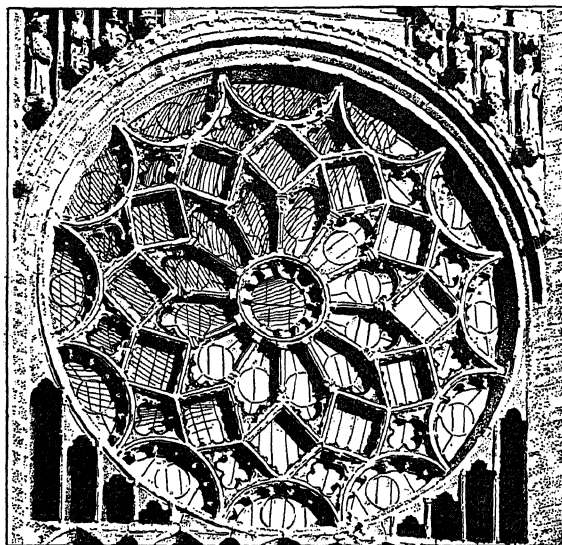


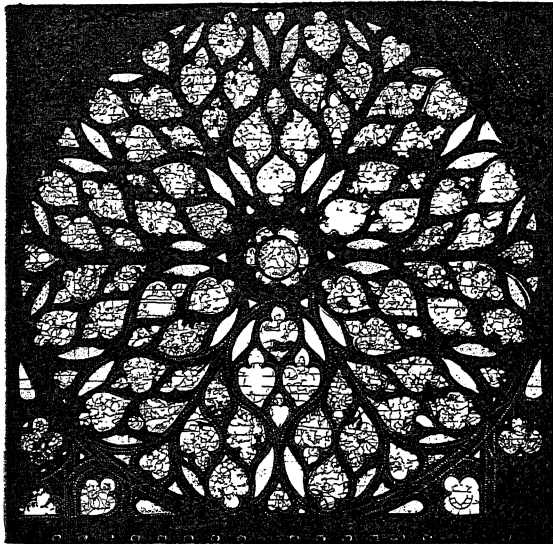
PLATE TRACERY
North transept rose window of Chartres Cathedral

are pierced in solid plates or thin walls. Bar tracery is that formed by separate thin bars with open spaces between them.

Origins. In the Byzantine and many early Romanesque styles it had become usual to group several small

openings together under one large enclosing arch. The tympanum, or surface between the small arch heads and the enclosing arch, was commonly thinner than the thickness of the surrounding wall. The Byzantines had also often used thin pieces of richly pierced marble, sometimes glazed, to fill window openings. With the piercing of the thin tympanum by a series of decorative openings, a simple and obvious step, plate tracery, had begun.

Plate Tracery. This decoration was characteristic of the early Gothic of France and England in the first decades of the 13th century. In the simplest examples the pierced holes were simple circles; but the cusped circle, one broken into a series of curved lobes or foils by projections inward called cusps, was soon more common, and as technical skill increased, the area of the openings and the richness of their arrangement continually increased. The most beautiful French examples are those found in Chartres Cathedral, com-

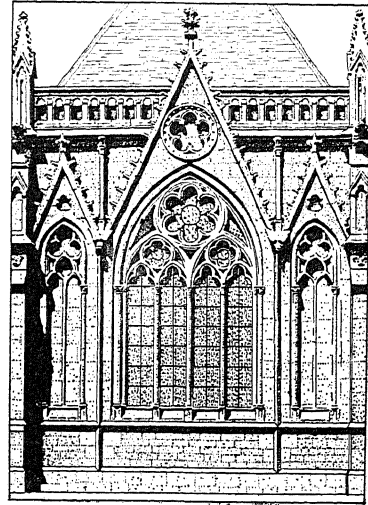


ROSE WINDOW WITH FLAMBOYANT BAR TRACERY
Sainte-Chapelle, Paris. 15th century

pleted by 1212; the loveliest English is the round window called the Dean's Eye in Lincoln, 1220.

Bar Tracery. Apparently this tracery came into use first between 1220 and 1230. A simple form occurs in the clearstory windows of Notre Dame, Paris, inserted after a fire during this decade; and a richer, more highly developed form in the chapels at Amiens, by 1230. Early bar tracery is strictly geometric in design; the window is divided into two lights by a central mullion, and above the arches over the lights is a circle, with or without cusps. Later large windows have three or four lights, those with four being treated like double two-light windows with an additional large upper circle. By the middle of the century there was the greatest freedom of combination of these elements, and arches as well as circles were often cusped. The elaborated type of geometric bar tracery in France is called *rayonnant*, possibly from the radiating character of the exquisite rose

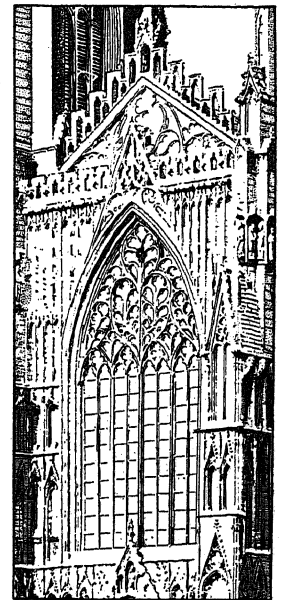
windows common in nave and transept ends. The end of the century also saw wall tracery used to a great extent.



GEOMETRICAL TRACERY
Exterior of the apse, Dijon Cathedral

Decorated Tracery. In England geometric tracery was developed to an even higher degree during the late 13th and early 14th centuries. All sorts of star shapes and cusped elements are found, and the large east or west windows frequently have six or eight lights arranged in pairs.

The English search for decorative richness in tracery led in the early 14th century to the discovery that by using curves of reversed curvature in the design, all sorts of gracious and elaborate flowing patterns could be produced. The simplest form was the network type, in which the window head was filled with an all-over pattern of repeated openings of the same size and with waving outlines; in larger windows, such as the west window of York, 1338, the utmost variety and imagination are present. It is from its tracery pattern that the Geometric and Curvilinear periods of English Gothic take their names.

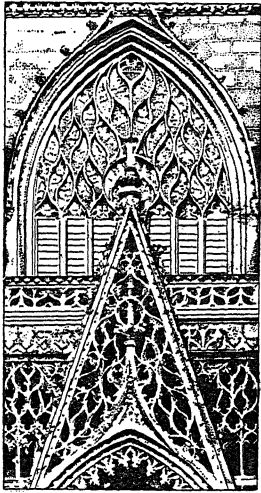


ENGLISH CURVILINEAR
TRACERY
*Window of the west front,
York Minster*

Late Gothic Tracery.

The resumption of building in France in the 15th century after the English wars saw the French adopting and modifying for their own use the curvilinear tracery of the English; the French type is called *flamboyant* from its common use of

flame-like, long, thin, waving shapes, much slimmer and often more graceful than the English examples. In later flamboyant work, however, in the 16th century, the French commonly used the round arch and ugly squat forms. A characteristic French development is the application of flamboyant forms to choir screens, stalls and canopy work, sometimes on a tiny scale, and unbelievably lace-like in execution.



FLAMBOYANT TRACERY
From façade of the Church of
La Trinité, Vendôme

Perpendicular or Rectilinear Tracery. During the last half of the 14th century perpendicular tracery was developed in England. It was the direct opposite of the curvilinear type, and became the common English style in the following century. Its underlying principle was the dividing of the window into a series of almost rectangular panels, larger below and smaller above, and with arched heads; shapes ideal for stained glass, as a figure could be placed in each. This was accomplished by running the vertical mullions straight through to the window head, and bracing them with horizontal members. The treatment at the top of the window varied greatly; intersecting arched bars were common. But the inherent awkwardnesses and the rectangular pattern meeting the arch were never completely solved. Perpendicular wall tracery was common on exterior walls, and also on tombs, choir screens, and altar reredosses, for which it was admirably suited.

Tracery Outside of France and England. In Germany tracery was usually under French influence in the earlier Gothic periods; as the style progressed fantastic Germanic shapes crept more and more into the designs. The work of the 15th and early 16th centuries in Germany and Flanders was remarkable for a characteristic combination of lavishness and heaviness, of small scale detail and weighty mass. There was a somewhat similar trend in Spain, where Flemish influence was strong in the late Gothic work.

The Italians never used tracery like the peoples

further north; they never understood its structural basis. To them it was always merely a new type of free ornament. They often copied its circles and little arches and cusps, but used them merely as forms to pierce in sheets of marble, frequently without any regard for the careful tangency of elements which controls good bar tracery. In Venice alone, in late Gothic work, a semblance of the northern types occurred in the tracery of the upper portions of the typical long bands of palace windows.

The Byzantine type of pieced marble pattern had its greatest development in various Moslem styles. Thus mosque windows are frequently filled with elaborate patterns of pieced stucco or cement with bright colored glass in the openings; the effect is intricate and jewel-like. The pierced marble panels of Mogul India are famous for their delicacy and grace; they represent probably the ultimate development of the pierced panel idea.

Modern Tracery. Usually modern tracery has been copied from, or developed out of, the tracery techniques of past styles. New, rather stiff rectilinear forms have been used in many new German churches. The most important fresh invention has been the creation of tracery by means of pierced, glazed, precast concrete tiles or blocks. Interesting examples can be found in various houses by Frank Lloyd Wright in America, and, on a larger scale, in the great windows of the concrete church at Raincy, 1924, near Paris, by the Perret brothers. See also GOTHIC ARCHITECTURE.

T. F. H.

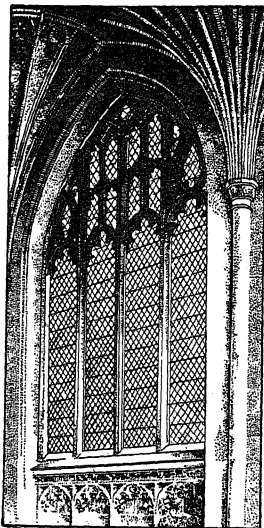
TRACHEA, or windpipe, a tube from three and a half to four and a half inches long, extending from the larynx downward to a point where it divides into two large bronchi. Each bronchus proceeds to one of the lungs, where it divides off into minute bronchioles. The esophagus lies behind the trachea.

The tracheal tube is composed of a fibro-elastic membrane, which is kept from collapsing by from sixteen to twenty rings of cartilage. The trachea is lined with mucous membrane, and its function is to conduct fresh air to the lungs and expired products away from the lungs.

Acute catarrhal inflammation of the trachea is a rather common disease, although rarely serious in the healthy adult. It is usually an acute infection, beginning as a simple cold and extending to the air passages. The most marked symptom is coughing with expectoration of a tough, tenacious or even gelatinous mass of sputum. The disorder usually clears up within two weeks.

Foreign bodies sometimes enter the trachea, though they usually become lodged at the entrance of the larynx. A violent fit of coughing ensues, which may succeed in dislodging the offending particle. To save the life of the patient in this condition, and for other conditions, as diphtheria or edema of the glottis, tracheotomy is sometimes necessary. This operation consists in making an artificial hole into the trachea from the front of the neck, and usually the introduction of a tube.

W. I. F.



PERPENDICULAR TRACERY
Window of the retrochoir of
Peterborough Cathedral

TRACHOMA, a serious, widespread disease that affects primarily the lining membrane of the eyelids. Historically, the origin of the disease is unknown, although it is erroneously supposed to have been brought to Europe from Egypt by Napoleon's army. Geographically, trachoma is not only prevalent but even endemic in the low countries, particularly those bordering the Mediterranean, while in mountainous regions and colder climates, it is found only sporadically. In the United States, trachoma is found in the hill counties of Kentucky and Tennessee, among certain tribes of Indians and, to a lesser extent, in dusty, wind-swept regions west from the Mississippi River.

That the disease is caused by some microorganism is fairly certain, although definite proof of the germ has not yet been substantiated. The contagious nature of the disease is well recognized and it is known that transmission occurs by direct contact only.

The incubation period is from fourteen to eighteen days and most usually both eyes are affected simultaneously, although unilateral trachoma occurs in about 3% of the cases. The first stage of trachoma is difficult to differentiate from a simple acute infectious conjunctivitis, for the eyelids are swollen, the lining membrane is red and thickened, and there is a fairly profuse discharge of pus. In the second stage, the lining membrane of the eyelids (conjunctiva) presents a granular appearance, from which the old name of *granular conjunctivitis* was derived. With time and treatment, this gradually progresses to the third stage, where the granular appearance is replaced by scarring of the conjunctiva. If that scar tissue contracts, it distorts the eyelids, causing an inversion of the eyelashes so that they rub continually against the eyeball and resulting only too frequently in destructive ulcers. Many other complications may result from the disastrous scar tissue contraction of the fourth stage of the disease.

Long-continued and persistent treatment is necessary to control the disease in order to avoid the dangerous consequences; it may be said that two years are required to bring a case of trachoma under proper control and even then there may be acute recurrences. The serious nature was recognized by the Government in barring all emigrants with trachoma from this country. *See also* BLINDNESS, MEDICAL ASPECTS OF; LIGHT, ARTIFICIAL, IN TREATMENT OF DISEASE.

H. S. G.

TRACHYTE, often spelled trachite, a light-colored, volcanic rock, the finely crystallized equivalent of the **SYENITES**. The component minerals are principally **ORTHOCLASE**, with the dark silicates, **HORN-BLENDE**, **AUGITE** and black **MICA** in subordinate amounts. **QUARTZ** is lacking, thus distinguishing the syenite-trachyte group from the granite-rhyolite one. Trachytes are commonly gray, yellow, or reddish in color.

A moderately porphyritic structure, with orthoclase phenocrysts, is common, but when very fine-grained, the trachytes can hardly be distinguished from the

RHYOLITES, **DACITES** and **ANDESITES**. All are then called **FELSITE**. The name trachyte is derived from the Greek adjective for rough, in allusion to the rock's typically rasping surface.

Some use is made of trachytes for structural purposes, particularly in the western United States, where they are not uncommon. Otherwise, they are somewhat rare, but are known along the Atlantic coast and in Missouri as well as in France, Italy and along the Rhine. *See also* PORPHYRY; PITCHSTONE; LAVA; PETROLOGY; GRANITE.

TRACK AND FIELD SPORTS, known as athletic sports in England, include running, jumping and throwing weights, as the discus hammer or javelin. Interest in organized competition in these sports dates back to 1866, when the British Amateur Athletic Association held its first championships. These antedate amateur athletics in United States. Even back in those days some noteworthy achievements were developed; but with the improvements in tracks, jumping pits and implements used, there seems to be no limit to human speed and endurance.

Sprinters. Though there have been phenomenal records made in long-distance running, there has not been any great improvement in the speed of sprinters. England led the world with its famous Sheffield Handicaps, a contest for professionals held almost annually from 1869 to 1899. Big stakes were the prizes, and big money was wagered on the respective athletes. The amount of the purses were from 50 to 100 pounds. The distance might be anywhere from 120 to 206 yards. Some Americans were successful in capturing the event. Most of the athletes of the United States competed under assumed names. The first American to win was George Smith of Pittsburgh, being victor in 1881. H. M. Johnson was the second American who won the event, in 1886; and the third was Edward S. Donovan, of Natick, Mass., who was twice the winner, once under his rightful name in 1889, and as J. Early in 1893. Two Americans were successful in 1890, J. Collins and M. Donlan. There were as many as eight handicaps in a year. Thomas F. Keane, Syracuse University track coach, was the last American to win. In fact he won the event three times, twice in 1898, and the last time in 1899. Scanning over the records, Edward S. Donovan, known as Piper Donovan, in 1895 at the Brockton Horse Track on Labor Day, won the American Professional 100-yard sweep stakes in 9 $\frac{3}{5}$ sec. He defeated Tom Morris, Walter Christie, coach of the University of California, and Bob Brown of Lynn, Mass. On measuring the track it was found to be one-sixteenth of an inch down grade. Arthur F. Duffey, of Boston, and representing Georgetown University, ran the 100 yards in the Intercollegiate track and field championships at Berkeley Oval, New York, in 1902, in 9 $\frac{3}{5}$ seconds.



GREEK SHORT-DISTANCE
RUNNERS
From a Greek amphora

Duffey won the event three years in a row; but the record of the "Fastest Human" of those times was stricken off the books by the AMATEUR ATHLETIC UNION because of a breach of the amateur laws a few years after his accomplishment. Great Britain, however, continued to allow Duffey the record, as he showed England he was worthy of the figures because he won the British championship four times: in 1900, 1901, 1902 and 1903, in 10 sec.

The United States has developed many remarkable sprinters, Howard P. Drew, Charles W. Paddock, George Simpson, Charles Borah, Roland Locke, Frank Wykoff and Edward Tolan. All of these men were credited with $9\frac{3}{5}$ sec. or better; but not until the International Amateur Athletic Federation met in 1929 was the time shortened to $9\frac{5}{10}$ sec. as the world's best mark, and credited to Tolan. The improvement of dash men may be noted in the 100-meter sprint in the Olympic Games. Thomas E. Burke, of Boston Athletic Association, Boston, Mass., won the event in 12 sec. in the first Olympic Games in 1896; but the Olympic record of $10\frac{3}{5}$ sec. was made by Harold Abrahams of England in 1924 at Paris. Frank Wykoff, of Glendale High School of California, in the final Olympic try-outs at the Harvard Stadium in Allston, Mass., July 5, 1928, in each of his four heats, equaled the Olympic record of $10\frac{3}{5}$ sec. The world's record of $10\frac{3}{5}$ sec. was made by C. W. Paddock of California in 1921 and equaled by Ralph Metcalfe of Marquette University in 1932.

Distance Running. No history of track and field sports would be complete without mentioning that superlative athlete, Paavo Nurmi of Finland. Never has there been such a running machine, perfect in rhythm. He achieved things that bordered almost on the unbelievable. The Phantom Finn, a sobriquet given him, started his international competition at the Olympic Games held in Antwerp, Belgium, in 1920. No one expected Finland would develop a greater athlete than Hannes Kolehmainen, who was the star of the Olympic Games of 1912 at Stockholm, Sweden, when Kolehmainen won the 5,000- and 10,000-meter runs, and led in the team race and the 10,000-meter cross country run. Nurmi captured the 10,000-meter run at Antwerp, but was beaten by Josef Guillemot of France, in the 5,000-meter event. In Paris, at the Olympic games in 1924, Nurmi set new records that are not likely to be beaten. He won the 1,500- and 5,000-meter runs, led Finland to victory in the 3,000-meter team race, and on one of the severest hot days of France, captured the 10,000-meter cross country run.

Nurmi made his first appearance in the United States at the indoor games of the Finnish American Athletic Club at the old Madison Square Garden, New

York, Jan. 6, 1925. Running indoors was something new to him; but he broke his greatest speed under unfamiliar conditions, running two races in new indoor figures. In five months he had bettered more than 40 records. Nurmi did what few men would undertake. On successive nights he ran in New York jumped to Chicago for the next night, and raced back to New York the following night, and won all three races. He was not beaten in any of the scratch race at his favorite distances, but just before sailing home he engaged in a half-mile race against Ala Hellfrich of the New York Athletic Club only to be beaten. It was thought in 1928 at the Amsterdam Olympics that Nurmi was about through, as he was successful in capturing only the 10,000-meter run in the record time of 30 min., $18\frac{1}{5}$ sec. He was defeated in the steeplechase and 5,000-meter events. But the man who held the world's records for nearly all distances from a mile (4 min., $10\frac{2}{5}$ sec. made at Stockholm in 1923) to the Marathon was far from being tried. On July 24, 1931 he made a new record for a two mile run, making the distance in the almost unheard figures of 8 min., $59\frac{3}{5}$ sec., at Helsingfors, Finland.

Nurmi's world record for the mile on an indoor track was broken in 1932 by Gene Venzke, who covered the distance in 4 min. $11\frac{1}{5}$ sec. at New York.

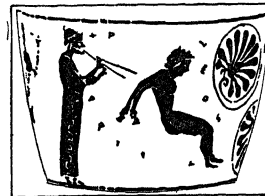
The Olympic team sent to Stockholm in 1912 by the United States was its greatest. Then the number of entries was not limited as after the World War. It was at Stockholm that James E. Meredith, a school boy, startled the world by making a new world record for 800 meters and 880 yards. The United States sent four of the greatest half-milers to Sweden, and Merwin W. Sheppard, Ira Davenport and Edmundson finished in that order behind the youngster. Meredith then continued his success as a student at the University of Pennsylvania, when he made new world marks for 440 yards, in $47\frac{2}{5}$ sec., and 880 yards, in 1 min., $52\frac{1}{5}$ sec.

Dr. Otto Peltzer of Germany took the half-mile record away from Meredith, winning the British championship in 1 min., $51\frac{3}{5}$ sec., July 3, 1926 at London. He defeated the great Douglas G. A. Lowe of England, who twice won the 800-meter run at Olympic games, being successful at Paris in 1924 and at Amsterdam in 1928. Lowe holds the world's record of 1 min., $10\frac{3}{5}$ sec. for 600 yards.

The United States has had some remarkable mile runners. These include Thomas Conneff, Norman Taber, Joie Ray, John Paul Jones of Cornell, Lloyd Hahn, Leo Lermond, Ray Conger, R. Hills and Ab R. Kiviat. Jones established a new Intercollegiate A.A.A.A record, running the mile in 4 min., $14\frac{1}{2}$ sec. W. G. George of England and George B. Tinch of Ireland were the best professional milers. The most consistent of American Marathon runners is Clarence



GREEK LONG-DISTANCE
RUNNERS
From a Greek amphora



COURTESY BRITISH MUSEUM
GREEK JUMPER IN MID-AIR

E. DeMar of Keene, N.H., and Melrose, Mass.; but he was never able to win the Olympic event. Only once was an American a winner of the Olympic Blue Ribbon event. John J. Hayes of New York, at London in 1908, was declared winner when Dorando of Italy was disqualified because English officials had picked him up and walked with him as he had fallen.

The first American Marathon race was run from Stamford, Conn., to New York, in Sept. 1896. The Athletic Committee of the Boston A.A., whose team of athletes won the first Olympic games at Athens, Greece, selected a course for its annual Marathon, and laid out a trail figured to be the same as from Marathon to Athens, Greece. The Grecian distance was believed to be a trifle short of 25 miles, and it generally was accepted; but at the Olympic games, London, the distance was made 26 miles, 385 yards, from Windsor Castle to Shepherd's Bush, in order that a member of England's Royal Family, who could not go to the Stadium to see the finish, might see the start of the race. Ever since, 26 miles, 385 yards, has been accepted as the regulation Marathon distance.

Field Events. The records in field events have been as outstanding as those in the track contests.



COURTESY M. M. OF ART

GREEK DISCUS THROWERS

In the running broad jump E. O. Gourdin, the Harvard colored athlete, was the first one to clear 25 feet. De Hart Hubbard of Michigan, Robert L. LeGendre of Georgetown University and Edward Hamm of the Georgia School of Technology with 25 ft., 11 1/8 in. records were beaten by S. Cator of Haiti, who jumped 26 ft., 1/8 in. at Paris, Sept. 9, 1928.

To Harold M. Osborn, of Chicago, belongs the running high jump record of 6 ft., 8 1/4 in., and to Lee Barnes of California the pole vault mark, made at Fresno, Cal., of 14 ft., 1 1/2 in. Robert A. Gardner of Yale was the first man to clear 13 ft., 1 in. in 1912 at the intercollegiate championship, and Sabin Carr of Yale was the first man to do 14 ft., at the Intercollegiate A.A.A.A. championship in 1927.

The Pacific Coast presents the best shot putters in the United States; but the world's record for the 16 lb. shot put, 52 ft., 8 3/8 in., belongs to Leo J. Sexton of Garden City, N.Y., this record being made in June 1932. Eric C. W. Krenz of California leads in the discus throwers, with 163 ft., 8 3/4 in. The javelin throw accepted by the governing body is held by E. H. Lindquist, of Sweden, with 232 ft., 11 3/8 in.

For years Earl Thomson of the United States held

the championship in the 120-yard high hurdles; but Steve Anderson of Washington University, Sentman of the University of Illinois, and Beard of the New York Athletic Club have all equaled the 14 2/5 seconds made by Thomson at the Intercollegiate A.A.-A.A. meet in 1920. George Saling, of the University of Iowa, made a new record in 1932 with 14.1 sec.

Track and field sports have been enjoying a healthy growth in the United States. The Pacific Coast, the Middle West and South especially improved under the excellent grooming their athletes have received from first-class coaches. The colleges now furnish most of the star performers. The same is true of nearly all the European countries, Japan and Australia. See separate articles on the individual sports.

J. J. H.

TRACK PAN, a trough 6 to 8 inches deep, 20 to 30 inches wide and 1800 to 2700 feet long, "dapped" into the ties at the center of a railroad track, from which water is scooped into the tender without stopping the train.

TRACT, a short book or PAMPHLET dealing in plain, forceful language with some timely problem of practical religion. Since the 17th century it has been used extensively in Europe and America to spread Christian knowledge among the common people. Famous American tract societies, organizations which publish and distribute tracts on a gigantic scale, are the Methodist Book Concern, founded 1789; Massachusetts Society, 1803; New York Society, 1812; and the New England Society, 1814, which became in 1823 the American Tract Society. In the Roman Catholic Church, a tract is a penitential anthem, consisting of Scriptural verses sung after the gradual from Septuagesima until Easter.

TRACTION, ELECTRIC. See ELECTRIC TRACTION.

TRACTORS, the general name for any self-propelled vehicle that takes the place of domesticated draft animals for hauling or similar work. Tractors are occasionally powered by STEAM ENGINES or OIL ENGINES, but the INTERNAL COMBUSTION ENGINE, in sizes ranging from one horsepower in the smallest garden tractor or lawn mower, to more than 80 horsepower in the largest units, is the most usual type of drive.

The engine is generally connected through a clutch and gear box to 1. Driving Wheels—usually of heavy steel construction provided with "cleats" to afford a high draw bar efficiency, though for more difficult work, the CATERPILLAR TREAD is very generally used; 2. a Pulley for driving general mechanisms, such as power saws and the like; or 3. a Special Power Take-off for driving special machinery, such as mowers and the like. GOVERNORS, generally of the centrifugal type,



COURTESY M. M. OF ART

GREEK ATHLETE THROWING A JAVELIN

are most usually employed to keep the engine speed within the most efficient range—from 600 to 1,500 revolutions per minute. Two or three speeds forward and one reverse are usually provided.

For agricultural uses, the tread of the rear wheels is sometimes adjustable, so that the machine may straddle the varying distance between rows of planting.

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TRADE ACCEPTANCE, a time draft or **BILL OF EXCHANGE**, for the purchase price of goods payable on a certain date, at a certain place, drawn by the seller of merchandise on the buyer, and who accepts it on its face. Designed to provide a means of definite acknowledgment of commercial accounts between merchants and their customers, it supersedes the open book account in all cases where business is not done on a cash basis. When properly used it is drawn for the amount of the invoice or for a series of invoices within a month, for a period not exceeding the usual open account terms of the seller and is for current transactions and not for borrowed money or past due accounts.

The buyer accepts the draft of the seller by writing his name, the date and the place of payment on its face and thereby becomes primarily liable for its payment at maturity. It is a prime type of two name **COMMERCIAL PAPER**, is readily discounted by the banks and may be rediscounted at the Federal Reserve Banks (*see* **FEDERAL RESERVE SYSTEM**) by a member bank.

R. H. B.

TRADE AGREEMENTS, modifications of the free competition which has been the ideal of the majority of economists since **ADAM SMITH**. At no time, however, has this ideal been accepted by business men or economists without some qualifications, the most commonly accepted deviation from the principle being in favor of so-called natural monopolies such as the provision of gas, electricity and water in municipalities, and in favor of legal monopolies to investors and authors. Generally speaking, cutthroat competition has also been regarded unfavorably, though partly for different reasons, by most business men and economists. Consequently there has been a policy of live and let live among men in the same line of industry or commerce which has frequently developed into more or less formal agreements. When these extend beyond the simple agreement between two local coal dealers, for example, not to cut prices below a definite level to include an appreciable part of a trade they become trade agreements.

The most effective organization for securing them is the **TRADE ASSOCIATION**. The business activities upon which agreements have been made are almost indefinite in number, but in the past they have most often related to prices, production and sales territory. Because of the conflict between existing legal restraints on such agreements and a growing realization of possible advantages to the community from some of them, the present tendency of opinion is more favorable to them.

C. A. G.

TRADE ASSOCIATIONS, as officially defined by the American Trade Association Executives, "organizations of producers or distributors of a commodity or service upon a mutual basis for the purpose of promoting the business of its branch of industry or commerce and improving its service to the public." Although rather generally believed to be 20th century phenomena, trade associations have been more or less active in the United States since the Civil War. The explanation of the popular misapprehension concerning them is probably to be found in the fact that the movement was greatly stimulated, in part by the Federal Government, during the World War.

The membership of a trade association consists of manufacturers, jobbers, wholesalers or retailers; or, in rare cases, combinations of two or more of these groups. It differs from a local manufacturers' association or a **CHAMBER OF COMMERCE** in that its membership is confined to concerns within one industry or a closely related group of industries. Typical associations are the American Association of Creamery Butter Manufacturers, the American Iron and Steel Institute, the Bicycle Manufacturers Association, and the Writing Paper Manufacturers Association. In geographical extent trade associations range from those limited to a single city to those organized nationally.

The activities undertaken by these organizations have varied greatly, not only from association to association but also with the passage of time. Early groups of the '60s and '70s tended toward a narrow range of activities which may fairly be termed restrictive; in fact, many of them were in this regard hardly distinguishable from the pools and gentlemen's agreements of the period whose chief object was the enhancement of prices by restriction of output or other devices. In the late '80s and '90s a definite trend toward more constructive activities began. These have fairly recently been classified by the Federal Department of Commerce as statistics, cost accounting, industrial research, commercial research, simplified practice, industrial standardization, public relations, trade relations, credit, insurance, employer-employee relations and traffic and transportation. In carrying out these activities trade associations have developed uniform accounting systems for their members, served as a credit bureau, induced members to settle disputes by industrial **ARBITRATION**, established joint research laboratories, and other services suggested by the classification headings just enumerated.

The dissemination of trade statistics has on several occasions brought trade associations into conflict with the antitrust laws. In general the charge of the Department of Justice in such cases was that the exchange of detailed information among members of associations on their production, costs, sales, credit terms, stocks of goods or price lists, eliminated competition in any valid sense of the term, and that the real purpose of such practices was not stabilization of industry as claimed but restriction of output and

undue enhancement of prices. The trend of court decisions, however, has been to permit somewhat more of these cooperative activities. Meanwhile, many students of such matters have come to the opinion that trade associations may prove to be the means of securing many of the advantages of combination without incurring the abuses of which some of the old trusts were guilty. C. A. G.

TRADE BOARD. See **BOARDS OF TRADE.**

TRADE COMMISSION, FEDERAL. See **FEDERAL TRADE COMMISSION.**

TRADE DOLLAR, a piece of silver authorized by the United States Congress in 1873. It contained 378 grams of pure silver while the standard silver dollar contained but 371¼ grams. The trade dollar was not intended to circulate in the United States, but was coined expressly for merchants trading with Oriental nations where coins with a high silver content were especially valued. By an unintentional provision of the Act of 1873, these coins were made **LEGAL TENDER** in payment for sums less than \$5.00. A fall in the value of silver relative to gold in 1876 made the pure silver in the trade dollar worth less than a gold dollar, and money speculators put the trade dollar into circulation in the United States. By an Act of 1876, all legal tender character was taken from the trade dollar, and shortly afterwards the Secretary of the Treasury suspended its coinage. In all 35,965,924 trade dollars were coined.

TRADE-MARK, a name, symbol or device adopted by a trader or manufacturer and borne by his goods to identify them and protect him from fraudulent imitations. A trade-mark gives the manufacturer or tradesman the exclusive use of the **GOOD WILL** created by producing quality goods and by advertising. It differs from the **PATENT** and **COPYRIGHT** in that it does not confer the privilege of exclusive right of manufacture or use, and in that the protection lies in the device or symbol used to designate the goods and not in the nature of goods themselves. The patent and copyright function to protect the commercial interests of one who has originated an article while the trade mark protects commercial interest of one who expects to establish the good will of the public toward his products. According to court decisions, the primary function of the trade-mark is to indicate the producer or owner of an article, and to be valid it must be of such nature as to accomplish that function. Names indicative of the quality of a product can not be used as trade-marks, nor can geographical names where they bear any relation to the product concerned. If the name of a company, firm or individual is used it must be represented in a distinctive manner. Invented words, signatures and various designs are frequently employed as trade-marks. Provision for trade-mark protection in the United States was first made in 1870 and the more important features of the present law were enacted in 1905 with minor amendments in 1906, 1907 and 1909.

TRADE NAME, a term frequently confused with trade mark probably because it is sometimes used to

include terms which may be technically used and registered as such. Thus a trade mark which may be, on the one hand, a mere geometrical figure may be, at the other extreme, a coined or other descriptive word capable of logical use as a trade name of the product upon which it is placed.

It seems more accurate, however, to think of trade name as designating a descriptive or fanciful name used to identify some proprietary article, the name by which an article is known to people engaged in the trade dealing with it, or the name or style under which a particular business enterprise is carried on. Such a name would not also be a trade mark if not affixed to goods to be sold and not subject to exclusive appropriation. Trade names which are not used as and do not become technically trade marks are now given much the same legal protection as the latter.

Nonexclusive trade names may be open to common usage in some well known, primary sense but also have public recognition in a secondary sense as indicating the goods or business of a particular trade. When so understood the trade name belongs to the one who first adopted and used it in such secondary sense in the business in question and its owner is protected from unfair competition through its use by a competitor.

It has been said that this doctrine of secondary meaning furnishes the foundation for the present great body of rules and principles of law directed to the prevention of unfair competition. Be that as it may, it is now clear that while the generic name of an article may be *publici juris* it may, when used by a trader, take on a secondary meaning as designating his products or goods. In such case, one who subsequently engages in the same business must avoid its use or qualify and explain it so that his goods may not become confused in the minds of the public with those of the prior trader or come to be known in the market by the name by which the goods of the prior trader are known and called for by the public. See also **TRADE-MARK**; **COPYRIGHT**; **PATENT.** C. M. U.

TRADE ROUTES, land, water, and air routes, although the last named are still comparatively unimportant. The most famous land routes in the world are those which connect the Black Sea and the eastern ports of the Mediterranean with India and China. Other ways of travel followed in ancient or medieval times passed through Russia from the Black Sea to the Baltic, crossed the Alps from northern Italy to France and Flanders, or followed the valley of the Rhone from Marseilles to the towns of northern France. During recent centuries the avenues of land communication have enormously multiplied. The principal sea routes are, however, still few in number, in spite of the invention of navigating instruments which have freed the mariner from close dependence upon the land. The most travelled of these sea routes is that connecting the western coast of Europe with the eastern coast of the United States. Besides the North Atlantic route there is the Mediter-

reanean and Oriental route, stretching from the United States and northern Europe through the Straits of Gibraltar and the Isthmus of Suez to the Far East; the Atlantic-Pacific route from the United States and northern Europe by way of the Isthmus of Panama into the Pacific Ocean; and some five or six others. The present direction of ocean travel is the result of the discoveries of COLUMBUS in 1492 and of VASCO DA GAMA in 1498. It is also the consequence of the opening of the Suez Canal in 1869 and of the Panama Canal in 1914. For sailing ships, routes have been influenced by the studies of Matthew Fontaine Maury, an American naval officer, one time in charge of the Department of Charts and Instruments at Washington, D.C., who devoted his life to the study of winds and currents, and achieved notable results. *See also SHIPPING ROUTES.* S.D.

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TRADES DISPUTES ACT, a law of Great Britain, enacted in 1927, which defines and restricts trade union rights. Its chief provisions are: it makes illegal sympathetic strikes and primary strikes not connected with conditions of employment when calculated to coerce the government, strikes that have any object other than the furtherance of a trade dispute within the trade or industry in which the strikers are engaged, and strikes intended to coerce the government by inflicting hardships on the community; it makes lockouts illegal; imposes criminal liability on union officials who further an illegal strike; makes union funds liable in respect of damages and forbids their use for political purposes; forbids civil servants to join any trade union not confined to employees of the Crown; empowers the attorney general to apply for an injunction restraining the use of trade union funds in contravention of the bill's provisions; enables union members expelled for refusing to join illegal strikes to claim damages.

TRADES UNION CONGRESS, a national organization of the British trade unions, meeting regularly in convention to pass upon the economic problems of the British labor movement. The Trades Union Congress is theoretically a federation of autonomous national unions covering specific trades or industries. It has no authority over the trade policies of its constituent unions, but settles disputes of demarcation between them. In practice, however, the Congress has frequently passed upon important questions of policy and action, going much further in the direction of centralization and concerted action than its counterpart in the United States, the American Federation of Labor. *See LABOR ORGANIZATIONS.*

TRADE UNION BENEFITS. *See LABOR UNION BENEFITS.*

TRADE UNIONS. *See LABOR ORGANIZATIONS.*

TRADE WINDS, regular winds blowing in a northeasterly and southeasterly direction in tropical regions, especially over the open oceans. They are caused by the difference in air temperature between

the equatorial and arctic zones on earth. The air in the tropics, being warmer, rises and flows toward the poles; the deficiency at the equator is then made up by a regular flow of colder air from the arctic toward the equator lower down, nearer the surface of the earth. It is these latter that form the trade winds. Originally blowing north and south, they are deflected by the rotation of the earth and are thus in the northern hemisphere northeasterly, and in the southern hemisphere southeasterly in direction.

TRADITIONALISM, the appeal to tradition. It varies according to time and place and is determined by the character of the traditional molds of thought under consideration. Any tradition which functions as traditionalism defeats the purpose of thought. Tradition may be quite necessary to thought; traditionalism, however, is destructive to it. Tradition may furnish data for thought; traditionalism acts as a check to thinking by confining it to certain bounds beyond which it may not leap. One may refer to the theological tradition, the Aristotelian tradition, the empirical or the rationalistic traditions, the idealistic or the Kantian, the scholastic or mediaeval traditions. As such they may further thought, but as dogmas to be defended, i.e., as traditionalisms, they impede thought.

TRAFALGAR, BATTLE OF, a naval encounter between the British and the combined French and Spanish fleets, which took place Oct. 21, 1805, off Cape Trafalgar, Spain, on the west side of the entrance to the Strait of Gibraltar. The battle was the most celebrated in the long career of the British Admiral, Horatio Nelson, who died as a result of wounds suffered during the engagement. With 27 ships disposed in two columns, Nelson met the French and Spanish fleet of 33 ships as the latter were making for Gibraltar in an effort to gain the Mediterranean. Admiral Collingwood, commanding a squadron of 15 frigates, fell upon the rear of the line of the French Admiral Villeneuve, while Nelson, further south, broke through the center, preventing Villeneuve's advance ships from turning north to aid the vessels under attack by Collingwood. Nelson captured 18 enemy ships. The victory of Nelson at the Battle of Trafalgar spelled the end of Napoleon's sea power.

TRAFALGAR SQUARE, an important square in the center of London, England, built to commemorate Nelson's victory at Trafalgar, 1805 (*see TRAFALGAR, BATTLE OF*). It was laid out in 1829-41 from designs by Sir Charles Barry, and occupies the site of the Royal Mews. At the center, dominating the square, rises NELSON'S MONUMENT. In other parts are statues of Sir Henry Havelock, Sir C. J. Napier, General Gordon and George IV. The NATIONAL GALLERY is on the north side, and at the northeast corner of the square is the church of St. Martin-in-the-Fields.

TRAFFIC CONTROL, the regulation of moving vehicles so that traffic may proceed safely and rapidly, though the means employed for safety is often detrimental to speed. Theoretically, for steady traffic at

30 miles per hour, 1200 vehicles per hour per lane can be moved, but mixed city traffic of two or more lanes each way under signal regulation will rarely exceed 700 cars per hour per lane. In 1930 average speeds of regulated traffic on Detroit Boulevards, seven miles out from the business district, did not exceed 15 miles per hour, indicating that with congested traffic, less than 30% of the ideal street capacity is secured.

Traffic regulation secures orderly movement in definite lines with the least possible loss of time due to the passage of cross traffic at intersections. Street car movement, as well as bus stops and cross movement of pedestrians, must be considered. Guide lines and stop lines on the pavement should be marked, and the placing of proper directional signs as well as the control of parking is necessary, but the most important matter is proper control at intersections. For less important corners, direct police control in the rush hour is sufficient, but main thoroughfares require properly timed automatic light signals. Under the "wave" or progressive system, vehicles may move several miles without stopping. Under the best automatic systems less than 40% of the street capacity is realized. Perhaps greater efficiency can be approached when the simple intersection is replaced by traffic "circles" of large diameter.

Street widening programs in large cities are providing improved traffic facilities. When ample space is secured at intersections, improvement is definite. Though costly, grade separations afford means for satisfactory vehicle movement. W. W. H.

TRAFFIC SIGNALS. See LIGHT SIGNALS; TRAFFIC CONTROL.

TRAGEDY, the term for that form of dramatic composition in which the theme is heroic, pathetic, mournful or terrible and which ends with the death

or defeat of the chief character. It is considered the most difficult form of the drama either for successful writing or for successful acting, being considerably more restricted in the range of themes at its disposal than COMEDY, and usually not so realistic in characterization or in subject as the less elevated and heroic forms. A tragedy may be



MASK OF A TRAGIC HERO

exact in its resemblance to life, but not necessarily so, and no less an authority than CORNEILLE asserted that its subject must not resemble life.

The essence of tragedy is in its profound concern with human weakness and suffering and its endeavor to excite sympathy for a character who is doomed to complete disaster. In the early tragedies of Greece man was ruled by the gods; his part in his own fate was small, and transgressions of the laws of Olympus led inevitably to swift retribution from above. By the time of Shakespeare, man's fate was in his own

hands; his own mind provided the sole punishment for his misdeeds: Hamlet's hesitation, his endless mental debates, bring doom to him and his house, and Macbeth finds his own Hades in the torment and remorse which assail him.

In the 19th century tragedy, or at least TRAGI-COMEDY, almost ceased to be written in poetical form, the claims of prose as being less artificial gradually winning an increasing number of adherents; but with the Greeks, the Elizabethans, and the French dramatists of the 17th century, poetry was obligatory for tragic dramatic compositions. See also GREEK, FRENCH, ENGLISH DRAMA.

TRAGI-COMEDY, a dramatic composition in which TRAGEDY and COMEDY are intermingled. The term was originated by an Italian dramatist of the Renaissance, Giraldi Cinthio, who wrote a tragedy with a happy ending, offering to term it a tragi-comedy if it were held that a sad ending was obligatory to a true tragedy. Since then, however, other somewhat varying interpretations have been given to the word. It has been used to describe any tragic play with comic interpolations (as in SHAKESPEARE), or any play that was serious in theme, but treated with a liberty of form forbidden by the rules of classical tragedy handed down from the Greeks.

The dividing line between tragedy and tragi-comedy is certainly not always very clear. Some critics have held that the chief difference lies in the fact that in tragi-comedy history and legend play a far less important part than in true tragedy. Others believe that the chief difference lies in the personages of the two forms, those in tragi-comedy being less heroic and of a less exalted social station than in tragedy. CORNEILLE considered his *Cid* a tragi-comedy and termed it so. Adherents of the old Greek tradition of tragedy would no doubt consider *Hamlet* a tragi-comedy owing to the interpolation of comic scenes. Perhaps the safest distinction to make between the two forms is that of the complete disregard of the old classical restrictions in tragi-comedy, notwithstanding the essentially serious nature of its theme.

TRAILS, INDIAN. The forested wilderness which confronted the European colonists along the Atlantic seaboard, the Gulf of Mexico and the St. Lawrence region was in fact interlaced by a rough system of footpaths, channels of communication between Indian tribes and towns. These narrow ways, in origin the natural results of everyday necessities and inclinations of the Indians, in route possessed common characteristics: preference for high ground, and particularly for watersheds, even at the expense of greater distance, to avoid morasses made by the overflow of streams and swamps in spring, and to minimize the danger from forest fires; consideration for the location of springs, and in general endeavor to provide a route which should furnish the necessary water for the travelers; a tendency to cross streams at confluences, to take advantage of the sandbars. The trails, used by the Indians for centuries, were deeply indented; certain war trails had been trodden

down as much as 12 inches when white explorers first made use of them. Since they had been formed by the passage of Indians in single file, all trails were extremely narrow, and some required a practiced eye to discern them. Fur traders and explorers found these trails invaluable; from some of these skeletal paths highways of pioneer travel developed. The most important Indian trails were the OLD CONNECTICUT PATH, Warriors' Path, Kittanning Path, NEMACOLIN'S PATH, the IROQUOIS TRAIL, the GREAT TRAIL, the VENANGO TRAIL, and the SCIOTO TRAIL.

TRAIN CONTROL, AUTOMATIC. See RAILROAD SIGNALING AND INTERLOCKING.

TRAINING CAMPS. See CITIZENS' MILITARY TRAINING CAMPS.

TRAINING REGULATIONS, a series of pamphlets, published by the U.S. War Department, containing information needed for the military training of individuals in basic subjects and of units in the tactics and technique of their arm of service. They are supplemented by technical regulations and training manuals containing detailed data on various materials and on special subjects. Examples of subjects dealt with in training regulations are military training, basic, interior guard duty, combat principles—The Rifle Company, tactical employment of field artillery, training remounts and technique of 37-mm. gun fire.

TRAINING STATIONS, U. S. NAVY. See NAVAL TRAINING STATIONS.

TRAJAN (MARCUS ULPUS TRAJANUS) (53-117 A.D.), Roman Emperor, 98-117. Born in Spain and after a rigorous military training which acquainted him intimately with the provincial and frontier problems of the empire, in 91 he attained the consulship and later became governor of Upper Germany. Adopted as son and successor by the Emperor NERVA, he devoted himself on his accession to strengthening the frontier defences between the head waters of the Rhine and the Danube. Arriving at Rome in 100 Trajan won the affection of the people and Senate by his affability and respect for constitutional government. He then devoted five years to the conquest of Dacia, in which he departed from the conservative frontier policy adopted by Augustus and observed by his successors. After an interval of peace Trajan conducted several vigorous campaigns, 115-116, against the Parthians, penetrating to the heart of their empire and taking Ctesiphon, the capital. Trajan was obliged to withdraw from Parthia in order to suppress a general revolt of the Jews from Roman control in the east. Successful in this, Trajan planned a new invasion of Parthia. However a serious illness compelled him to set out for Rome, but death overtook him in Cilicia. HADRIAN, his successor, content with the Euphrates frontier, did not resume the invasion of Parthia. Trajan's column in Rome records the conquest of Parthia.

TRAJAN, RESCRIPTS OF, Roman Emperor 98-117 A.D. (see TRAJAN). A rescript is a reply to a definite question sent by an emperor, having the force

of law and applicable as precedent. Trajan's correspondence with PLINY THE YOUNGER, Governor in Bithynia, include many such official pronouncements, often in detail and on local subjects; as, the right of Prusa to build a bath-house, the saving of money in the diplomatic missions of Byzantium, etc. They show good sense and conscientious liberality, but they involve a principle of paternalistic interference which might be, and was, dangerous when exercised by a careless or autocratic emperor.

TRAMMING, in mining, the transporting of excavated ore and rock along the LEVELS of a mine to the SHAFT, where the material is hoisted to the surface. Tramming is done in small cars of about a ton capacity, propelled by hand, or drawn in trains by mules or electric locomotives, along light, narrow gauge tracks.

TRAMP SHIP. See SHIPS, TYPES OF.

TRANCE, a general term to include all states, light or deep, that depart from normal consciousness. A trance is a dazed or sleep-like state in which the subject is able to carry on some activities and is partially or selectively aware of his surroundings. The trance state of SOMNAMBULISM is familiar. The stages of hypnosis (see HYPNOTISM) represent different varieties of trance. Automatic writings (see AUTOMATISMS) are performed usually in a light stage of trance. Some spirit MEDIUMS enter voluntarily into a trance-like state. A deep stage of trance is the ECSTASY occurring in profound religious devotion. Trance states when developed merge into secondary personalities. The dramatic stages described in Flournoy's *From India to the Planet Mars* are trances developed by the subject in which she impersonates an Indian princess in one series and an inhabitant of Mars in another. Many revelations of religious or other character are claimed to be received in a state of trance; hence its association with inspiration.

TRANSCAUCASIA, a federation of Soviet Socialist Republics on the Caucasian Isthmus. It comprises ARMENIA and GEORGIA, within which lie the Adzhar and Abkhasian autonomous republics, the South Ossetian autonomous area and Azerbaidjan, which includes the Nakhichevan autonomous republic and the Mountain-Karabakh autonomous area. The 72,230 sq. mi. of territory, organized as a federation in 1922, are bounded by the Caucasian Mountains in the north; the Agridag Mountains, Aras River, Mugan Steppe, Talyshin Range and Astar River on the south; the Black Sea on the west and the Caspian Sea on the east. Turkey and Persia lie south of Transcaucasia. Of the inhabitants, 31% are Georgians, 23% Armenians, 29% Azerbaidjan Turks, 6% Russians and the remainder Ossetians, Abkhasians, Lesghis, Jews, Persians, Kurds, Germans, Poles and other nationalities. Despite the diversity of races, long association and mingling of peoples and cultures have given the regions a practically homogeneous character. Some important towns of Transcaucasia are Tiflis, Baku and Eriuan, which are the administrative centers respectively of Transcaucasia and Georgia, Azerbaidjan

and Armenia. Agriculture supports 80% of the population; cotton, grapes and tobacco are important crops. Cattle raising, silkworm culture, agriculture, oil production and mining are of considerable and growing significance. The railroad lines, which are being extended, now total 1,350 mi. Pop. 1931, 6,426,700.

TRANSCENDENTALISM, the *a priori* philosophy of IMMANUEL KANT; an American school closely associated with the name of RALPH WALDO EMERSON. The transcendentalism of Kant was quite a different thing from that of the Emersonian school. It was an attempt to find out what knowledge man possesses *a priori* and the conditions under which such knowledge is possible, together with its applications and limitations. (See CRITICISM, IN PHILOSOPHY).

American transcendentalism was a mystical philosophy stressing the oneness of God, the beauty of nature and the goodness of man. It was a monistic pantheism in which nature was regarded as rational and man as a part of nature. Nevertheless the transcendentalists were skeptical of the ability of reason to arrive at truth. Here the emphasis was rather upon feeling, each trusting his own inner light. Rebellious of authority, in their personal conduct, they were quite conventional. They believed in living close to nature. In their case individualism did not produce confusion and chaos for they were alive to social responsibilities to their fellow-man.

TRANSCENDENTAL NUMBERS, numbers which are not algebraic, that is, which are not roots of any algebraic equation of the form

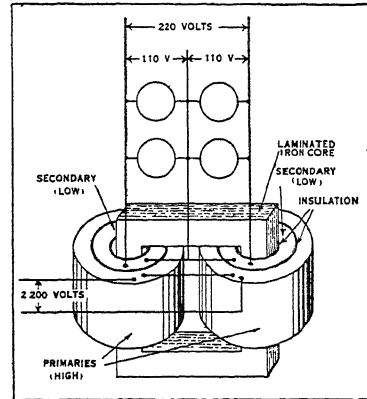
$$ax^n + bx^{n-1} + cx^{n-2} + \dots + px + q = 0,$$

where n is a positive integer and a, b, c, \dots, p, q are integers (including zero). The numbers π (π) and e and, in general, logarithms and trigonometric functions are transcendental numbers. See Π ; E (e).

TRANSFORMERS, devices for transferring electrical energy in an alternating current system from one CIRCUIT to another by means of a changing magnetic flux (see ELECTROMAGNETISM) which threads through and links the circuits together. In its simplest form it consists of a ring of laminated iron, called the core, about which are wound two separate coils of wire. When one of the coils, the primary, is supplied with an ALTERNATING CURRENT, an alternating magnetic flux is established in the core. This changing flux, as it surges through the other, or secondary coil, induces in it an alternating voltage. Any circuit connected to the secondary is supplied with current in response to the induced secondary voltage. Since the magnitude of the induced voltage in the secondary depends upon the number of turns of wire in the secondary coil, the secondary voltage may be larger or smaller than the voltage impressed upon the primary. When the secondary voltage is larger than the impressed primary voltage, the device is called a step-up transformer; when smaller, it constitutes a step-down transformer.

Power Transformer. The principal use of the transformer is in electrical power transmission. The

power transmitted in any circuit is proportional to the product of the voltage and the current. Hence, the same power may be transmitted at low voltage and high amperage or at high voltage and low amperage. But the heating effect in a given transmission line depends upon the current, or amperage, only, and increases rapidly with increasing values of the current. Practical transmission requires, therefore, the use of low current and high voltage. But power cannot be generated safely or economically at high



TYPICAL CORE-TYPE STEP-DOWN DISTRIBUTION TRANSFORMER REMOVED FROM CASE

Ratio 10 to 1

voltage chiefly because of insulation difficulties in the ELECTRIC GENERATOR, and because of the danger to attendants. Therefore, in practice, power is generated at relatively low voltages, say, at 1,000 volts, and is passed through a step-up transformer, where the voltage is raised to, perhaps, 100,000 volts for transmission. At this high voltage the power is passed over the transmission lines to the distant distribution systems, and, by means of a step-down transformer, it is reduced to a safe and convenient value for local use.

Instrument Transformers are used to transform the line voltage or line current to a value suitable for measuring instruments and relays. Potential transformers are merely step-down transformers of the general type discussed above. Current transformers are connected with the primary in series with the current-carrying line. The magnetic flux set up by the primary and hence that cutting the secondary is thus dependent only on the current in the line and the physical characteristics of the transformer itself. In low-current systems, a separate primary winding is used; in high-current lines, the current-carrying cable itself comprises the primary and the secondary is wound on a core which is slipped over the cable. Meter readings taken with instrument transformers must be multiplied by a factor to compensate for the transformer action.

Auto-transformers consist of a continuous single winding on one core, having the primary and secondary leads tapped off at different points. The two

circuits are thus connected both electrically and inductively. Auto-transformers are used to balance electrical circuits and for general power applications.

Constant-current Transformers are so designed that, regardless of the secondary load, the secondary current remains automatically constant with a constant impressed primary voltage. This is usually accomplished by having one coil movable and the other stationary. As the load on the secondary increases, the coils are moved automatically so as to decrease the flux linking the two windings and so lower the secondary current. Constant-current transformers are used in series street-lighting installations, so as to maintain a constant current even when some of the lamps are cut out of the circuit.

Voltage Regulators are used to vary, or regulate, the voltage of an alternating current circuit. They consist of the primary and secondary of a transformer or auto-transformer so connected that the mutual inductance between the two circuits can be varied. This is done either by cutting out portions of the winding or by moving one coil with relation to the other so that the flux linkage between the two coils and therefore the secondary voltage is varied.

Radio Transformers. Small power transformers are used in the **POWER PACKS** of radio receivers for stepping down the voltage of the 110-volt source to that required for the filaments of the tubes. An additional secondary winding steps up the voltage to that required for plate and grid bias potentials.

AUDIO FREQUENCY transformers are constructed somewhat similarly to small power transformers, except that both primary and secondary windings ordinarily consist of a very large number of turns of very small wire. These transformers are built to have approximately equal efficiency over the whole range of frequencies used in broadcasting. **RADIO FREQUENCY** transformers ordinarily have no iron cores. The degree of coupling between primary and secondary windings is small, as compared to the nearly unity coupling of the power transformers. In the case of the radio frequency transformer, either or both of the windings may be tuned by a **CONDENSER**.

L. B. S.; L. G. H.

TRANSIT, a term applied in the United States and in many other countries to a **THEODOLITE** in which the trunnions of the horizontal rotation axis are placed high enough so that the telescope is free to make a complete revolution about this axis. It is used: 1. To measure horizontal angles; 2. To prolong straight lines; 3. To aline points in a vertical plane such as columns; 4. To measure vertical angles, and 5. To measure distances by the stadia method. See **TACHEOMETRY**. When equipped with a spirit level on the telescope, it may be used as a **LEVELING** instrument. Transits are often equipped with magnetic compasses and, therefore, may be used for observing directions with respect to the magnetic meridian. When thus fully equipped the transit becomes the universal instrument of the surveyor. See also **SURVEYING**.

G. L. H.

TRANSIT, of a planet, etc., the name given to the phenomenon occurring when Mercury or Venus passes directly between the earth and the sun and appears projected against the sun's disk as a small black dot. Similar events may occur with satellites of Jupiter.

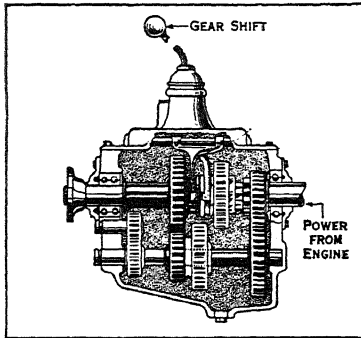
TRANSIT INDUSTRY, the industry represented by public transportation facilities for city, suburban and interurban service. Agencies employed in cities and their suburbs include electric street cars, subways, elevated railways, surface rapid transit lines, **TROLLEY BUSES**, **BUSES**, **TAXICABS** and electrified suburban railroads. (See **ELECTRIC RAILWAYS**.) Agencies for inter-city service include electric interurban cars, electrified railroad lines, buses and trucks (see **TRUCK**, **MOTOR**). Electric street cars for many years were the sole means of public transportation in large cities. Need for high-speed service over and under the streets brought rapid transit; improvements of cars, control and track led to the installation of electric interurban lines and the electrification of steam **RAILROADS**; and development of the **INTERNAL COMBUSTION ENGINE** for highway vehicles added the bus, taxicab and truck. To-day all of these agencies, coordinated wherever possible, having the same objectives, meeting similar problems and operated in many cities by one company, are recognized as elements constituting a single industry—transit.

At the beginning of 1932 transit lines in the United States totaled approximately 63,000 miles—34,000 miles of street and interurban electric railways, 1,100 miles of subway and elevated railways, 2,900 miles of railroad electrifications, 183 miles of trolley bus lines and 25,000 miles of bus routes (excluding routes operated by independent companies in communities under 25,000 population and interurban areas). Transit vehicles, totaling about 168,000, included 54,200 street and interurban cars, 9,500 rapid transit cars, 3,200 electric suburban cars, 225 trolley buses, 16,800 buses (same classification as for route mileage) and 84,000 taxicabs (those operated by responsible, organized companies). These agencies carried 14,212,000,000 passengers during 1931 and received a gross revenue of \$1,307,500,000. The total capital investment in the transit industry exceeds \$6,000,000,000.

C. A. F.

TRANS-JORDAN, a territory included in the Palestinian area granted to Great Britain by mandate, but actually governed by a local Arab administration. It is bounded north by Syria, south by Hejaz, east by Najd and Iraq and west by Palestine. The region occupies a considerable tract of the plateau on the eastern side of the Jordan Rift valley. It is agricultural and pastoral country merging eastwards into a desert. Amman is the principal town and is linked by motor road with Jerusalem and Jaffa. The Hejaz railway runs through Amman towards Mecca. In 1923, Britain agreed to recognize Abdullah, a brother of the king of Iraq, as an independent ruler of the territory. The population is about 260,000, mainly Arabs and Circassians.

TRANSMISSION GEAR, a set of gears in MOTOR VEHICLES occupying a position between the engine and the drive shaft, which permit variations to be made in the transmission ratio. Three or four forward speeds, with varying degrees of reduction, and one reverse are usually provided, high gear generally being a direct connection. In addition to the reducing



TRANSMISSION GEAR
Cross section

gears, which are actuated by the hand lever, there is another set of transmission gears, bevel or worm, on the rear axle or on a jack shaft, which effects a further fixed reduction, a so-called DIFFERENTIAL gear that allows the driving wheels to compensate for each other on curves. In steam- or electric-motored vehicles, change gears are not necessary, but, wherever the INTERNAL COMBUSTION ENGINE is used, provision must be made for a disconnection of the motor and for the multiplication of driving force, with a consequent reduction of speed. This is necessary in starting and in doing the heavy work required in climbing hills or moving heavy loads over bad roads. The CLUTCH provides the disconnection, the transmission gear a variation in tractive force. J. A. C. W.

TRANSMITTER, in communication systems, that part of the system which converts SOUND or other physical motion into electrical impulses for transmission to the receiver. In the TELEPHONE the transmitter is the MICROPHONE which comprises a diaphragm and a resistance unit composed of granular carbon which is connected to the telephone circuit and an electric battery. Sound waves made by the voice press on the diaphragm with a pressure which varies with the intensity and frequency of the sound. This pressure is transmitted to the granular carbon unit and varies the compactness of the loose granules and hence the RESISTANCE to current. The result is a series of current impulses which are carried to a distant point over a conductor and converted back into sound by a receiver. A conical or bell-shaped mouthpiece is generally used to collect and concentrate the sound waves upon the diaphragm. To reduce the resistance of the transmitter circuit and increase its sensitivity it is usually connected to the line circuit through an INDUCTION COIL, and its current is supplied by a local battery. In the TELEGRAPH the transmitter is a manually or automatically operated key which makes and

breaks the circuit to send current impulses. In RADIO, the transmitting set is connected to a microphone resembling that used in telephone. The transmitter converts the AUDIO FREQUENCY from the microphone into RADIO FREQUENCY for broadcasting.

TRANSMUTATION OF ELEMENTS. Years ago chemists sought a means, such as the PHILOSOPHER'S STONE, for the production of rare metals (gold or silver) in appreciable quantities from the baser elements.

In order to learn more about atoms, the scientists of to-day have used powerful electrical discharges in their attempts to break down the heavier elements into those of lighter weight, such as mercury into gold. Others have attempted to build helium by adding together hydrogen nuclei (protons). None have succeeded.

The radioactive elements (*see* RADIOACTIVITY), on the other hand, are continually emitting parts of their nuclei and gradually changing into lighter substances. As yet this action cannot be controlled by man. The end product is lead.

SIR ERNEST RUTHERFORD, however, has succeeded in knocking protons out of practically all the elements by bombarding them with ALPHA PARTICLES from radium C'. The collisions which bring this about are very rare, so that extremely small quantities of the material are involved.

In order to change one element into another, it is necessary to alter its NUCLEUS. *See also* CHEMISTRY. J. B. H.

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TRANSPIRATION, the loss of water from living plants. Practically all the water that is lost from plants escapes as water vapor from exposed parts. The leaves are by far the most wasteful in the loss of water, but all parts above ground lose some water. Transpiration occurs at all times but most water is lost during the daylight hours. This is due to functioning of stomata which close at night but open in light. Except where these special openings occur the cuticle of the average land plant is nearly impervious to water. Transpiration is generally regarded as a necessary evil for the plant. The exchange of gases between the plant and air necessitate opening of stomata and while they are open water vapor escapes. During very hot weather, however, the cooling effect from evaporation of water from the surface may be of some value. The escape of water into the stomatal chambers (the preliminary step to transpiration) is considered by some to be the chief cause of the ascent of sap.

P. W. Z.

TRANSPLANTERS, machines for transplanting such crops as tobacco, cabbage, and tomatoes which are grown from seed in hotbeds. These machines open the soil, deposit the plant along with a quantity of water, and then firm the plant in as they move forward. N. R. B.

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TRANSPORTATION, the conveyance of passengers and goods from one point to another by land, water or air. Transportation was first effected by man himself and then by domesticated beasts of burden. Later, vehicles were developed which could be drawn by man or beast. On the water the wind was harnessed to propel boats and that remained for centuries the most expeditious means of transport (*see SHIPBUILDING, HISTORY OF*). The steam engine, which made possible the steam boat in 1817 and later the railroad, was the first great impetus to transportation. Then electricity was used to drive railway cars and this form of transportation has been of ever-increasing importance during the past two decades. Next came the internal combustion engine which has made possible the automobile, the AIRPLANE and power-driven AIRSHIPS. With the development of good roads the AUTOMOBILE, the BUS and the TRUCK have become important means of inland transportation. Electrified steam railroads now have a substantial mileage and are being developed quite rapidly. Electricity is in almost exclusive use for urban transportation by rail. The latest developments in electric transportation are the oil-electric and gasoline-electric locomotives and rail cars, and the rubber-tired buses operated by electric power from overhead, known as TROLLEY BUSES.

Airplanes and lighter-than-air craft are in their infancy, but mail and passenger plane lines are now recognized as reliable and safe. Their great advantage lies in their speed. INLAND WATER TRANSPORTATION is limited largely to freight because of its low speed. On the HIGH SEAS, steamers and MOTOR SHIPS are used for all long and dangerous voyages. Sailing ships run largely on shorter voyages and carry principally freight. The latest development in water transport is the Diesel-electric driven ship which has rapidly increased in numbers in the last few years. *See SHIPS, TYPES OF*. Significant recent development has been made in the transportation of fluids, notably crude oil and gasoline by pipe lines. Pumping stations are located at intervals of 20 to 40 miles. Some of the lines have a total length of over 1500 miles.

TRANSPORTATION, AIR. *See AIR TRANSPORTATION.*

TRANS-SIBERIAN RAILWAY, the Russian railway across Siberia terminating on the Pacific at Vladivostok. Construction started in 1891 and was completed in 1905. The Chinese Eastern Railway in Manchuria, built by Russia under an 1896 agreement with China, was planned as an integral part of the Trans-Siberian line. Connections between the maritime provinces of Siberia and European Russia are also furnished by the railway line which follows the Amur River valley around the northern end of Manchuria. The Trans-Siberian Railway, from Tcheliabinsk in the Urals to Vladivostok, is about 4,500 miles long. It connects with other Russian lines which furnish rail transportation to Moscow and Leningrad. The railway was of great value to Russia in the Russo-Japanese war, and it has played a very large part in opening up eastern Siberia to settlement.

TRANSUBSTANTIATION, a theological term signifying the mystery by which, according to the Catholic belief, the substance of the bread and wine of the EUCHARIST, when consecrated by the priest at the altar, becomes the true body and blood of the Savior. The belief is based on Scripture, for instance, I Corinthians II: 23-28; John 6: 48-56, and developed in the undivided Church, Greek and Latin, at an early date. It is stated in the Creed of Pope Pius IV, promulgated after the Council of Trent in 1564. The service of the Mass, with reservation of the Sacrament or Host for purpose of adoration, is based upon the doctrine of transubstantiation. At the Reformation, Protestants rejected the doctrine which is condemned in Article 28 of the English Church. But the negative has been by no means simple. Lutherans have discussed consubstantiation, a term which suggests that the sacred elements become associated with the person of Christ. In the Anglican churches, the real presence of Christ in the Sacrament is strongly asserted especially by High Churchmen. Modernists in some cases attribute this range of ideas and the ritual arising out of them to Mithraic and other pagan mysticism.

TRANSVAAL, one of the four original provinces of the UNION OF SOUTH AFRICA lying inland between the Vaal and the LIMPOPO rivers. It is bounded on the north by Rhodesia, on the south by Orange Free State and Natal, on the east by Portuguese East Africa and Swaziland and on the west by Cape of Good Hope and Bechuanaland. Area 110,450 sq. mi.; pop. 1921, 2,087,636, officially classified as 543,485 Europeans, 32,291 mixed (as a result of the intermarriage of white settlers and natives), 1,495,869 natives and 15,991 Asiatics. The European population in 1931 was 695,963.

The surface consists chiefly of high veld, between 4,000 and 5,000 ft. above sea level, which feeds cattle, sheep, goats and horses; the middle veld is the name applied to the slopes by which the high veld falls to lower elevations; the low veld (below 3,000 ft.) slopes down to the Limpopo in the north and along the frontier of Portuguese East Africa. The low or bush veld is unhealthy in the summer. It is a fine cattle-raising region, but there are few sheep. Citrus orchards flourish.

The mineral resources of the province have determined the course of the modern communications and economic development of the Union as a whole. Most of the gold is obtained at great depth from the mass of hard rock in the Witwatersrand, an elevated ridge crowning a plateau which forms the divide between the tributaries of the Vaal and Limpopo rivers. The Transvaal gold output in 1928 was valued at about \$220,000,000. The province has a rich diamond region near Pretoria and produces valuable amounts of coal, tin, copper, asbestos, platinum and iron ore. Maize is the principal crop; cotton and tobacco are also grown and dairying is developing in some districts.

The chief towns are JOHANNESBURG, the largest town

in the Union and the leading industrial center; PRETORIA, the seat of government of the Transvaal and the Union; and the industrial towns of Germiston, Benoni, Krugersdorp and Boksburg.

Education in primary and secondary schools under provincial authority is free. There are four training colleges for European teachers and four for colored teachers. In 1928 there were 554 state and state-aided schools for mixed (colored), native and Indian children.

HISTORY

Because of dissatisfaction with the English government of Cape Colony large numbers of Boers migrated to the north in the third decade of the 19th century, and in 1840 the settlers entered into a loose confederation which finally resulted in the establishment of two Boer republics, the Transvaal and the Orange River territory. Bad feeling between the two republics and the English colonies to the south continually increased as the Boer states were gradually encircled by new British expansion.

The discovery of rich gold fields in Transvaal in 1868 brought in such a large number of turbulent adventurers, chiefly British, that the foreigners soon outnumbered the Boers. These undesirable elements demanded citizenship with the intention, the Boers feared, of voting the republic under the British flag. During the imperialistic régime of Disraeli the British Government, after a short investigation of conditions, in Transvaal, declared its annexation Apr. 1, 1877, on the grounds that the solution of native questions and the protection of the whites made necessary the consolidation of territory in South Africa. War followed. In 1884, by the Pretoria Convention, Gladstone recognized the self-government of the Transvaal on condition that all whites be permitted to live in the territory without any discrimination and that foreign treaties be made only with the consent of the British Government. The Boers, however, passed very stringent naturalization laws, and the English residents resented the imposition of taxes when they could not vote. The relations between the English Government and the Boers were made infinitely worse by the famous Jameson expedition which invaded the Transvaal in order to overthrow the Government. The raid failed; but Joseph Chamberlain accused the Boers of treating Englishmen unjustly and plotting to destroy Anglo-Saxon institutions in South Africa. The British Government insisted that foreigners be given a vote. The Boers refused the demand. The President of Transvaal, Paul Kruger, relying on outside support, which never came, sent a 48-hour ultimatum to the Cape Government Oct. 9, 1899. This was the beginning of the BOER WAR, 1899-1902. See also AFRICA, HISTORY OF; SOUTH AFRICA, UNION OF, HISTORY. A. P. W.

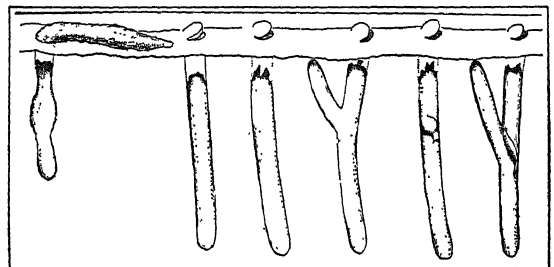
TRANSYLVANIA, a colonizing enterprise and separate government in the Kentucky country just preceding and during the Revolutionary War. The Louisa Co. was organized at Hillsborough, N.C.,

Aug. 24, 1774 by Richard Henderson and five associates. Shortly after it was renamed the Transylvania Co., and the number of members, all North Carolinians, increased to nine. At Sycamore Shoals, Watauga River, Mar. 17, 1775 the company purchased from the Cherokee, for merchandise valued at £10,000, a tract of about 20,000,000 acres between the south bank of the Ohio and the mountain ridge south of the Cumberland River, and from the head of the Kentucky River west to the watercrest between the Cumberland and Tennessee rivers. Despite denunciations of the project by officials as a usurpation of Virginian sovereignty and as an illegal private purchase, Henderson promoted the immigration of settlers into Kentucky. (See WILDERNESS ROAD.) At Boonesborough, one of the four settlements in Transylvania, in May 1775, delegates of the people ratified a constitution which, while providing for democratic institutions, made the proprietors the executive branch of the government with powers of absolute veto. Indian troubles and dissatisfaction with the constitution led to petitions to Virginia; and on Dec. 7, 1776 the state legislature created the county of Kentucky to embrace Transylvania.

TRAPANI, a city of Sicily, capital of the Italian province of the same name, situated on a sickle-shaped peninsula on the west coast of the island. It is the seat of a bishop. It has a cathedral in Late Renaissance style and several other churches of the 14th-18th centuries, a citadel and interesting medieval houses. There is a nautical school and various other educational institutions, as well as several museums. The industries consist of shipbuilding, and the manufacture of cameos, and articles of coral, and alabaster. The exports are largely salt, wine, and tunny fish. Pop. 1928, 71,346.

TRAPDOOR SPIDER, the popular name for any burrowing spider which closes the entrance to its house with a door. Two very different groups of spiders, the wolf-spiders or *Lycosida* and the *Mygalomorphæ*, include makers of trapdoor nests.

The trapdoor itself is made of silk, and it has a silken hinge. It is always covered with leaves or



NESTS OF TRAPDOOR SPIDERS (*Atyphus* sp.)

Left to right, nest with long entrance; nest with thick door; nest with thin door; branched nest; nest with two doors; and branched nest with two doors

similar debris, so that it is quite invisible when closed. The *Mygalomorphæ* make strong, spring-like hinges, that shut their doors smartly, but the wolf-spiders cannot make very good hinges. However, they often

insure the automatic closing of their doors by making them heavy on the side opposite the hinge.

All trapdoor nests are lined with silk, and some have two rooms separated by an inner door, beyond which the spider can retreat if an enemy forces the outer door. The householders lurk in their doorways, with the door just slightly open, and pounce on any insect that passes too near. Their egg cocoons are guarded in the burrow. *See also* SPIDER.

TRAPPISTS, the popular name for monks of The Order of Reformed Cistercians of Our Lady of La Trappe, an offshoot of the Cistercian Order under the Rule of St. Benedict and the Constitutions of Abbot de Rancé, 1664. When the French Revolution disorganized the Order of Cîteaux (Cistercians), Dom Augustine de Lestrange, superior at the Abbey of La Trappe, took 24 of his religious to the monastery of Val-Sainte, Switzerland, from which they made other foundations in Spain, England, Belgium, Piedmont and the United States until reinstated in France after Napoleon's downfall in 1815. The French monasteries were constituted the "Congregation of the Cistercian Monks of Notre-Dame de la Trappe" in 1834, but irregularities of observance caused their separation in 1847 into two congregations: "The Ancient Reform of Our Lady of La Trappe," conforming to de Rancé's regulations, and "The New Reform of Our Lady of La Trappe," following the Benedictine Rule, both under the Cistercian Moderator General. This arrangement strengthened the order, which in 1892 was able to reunite under Dom Sebastian Wyart; two years later its present Constitutions were approved and in 1898 Cîteaux was restored as motherhouse. There are now 57 monasteries in France, Belgium, Germany, Italy, Syria, the Far East, the United States, Canada, England and Ireland, and approximately 3,000 religious, besides many convents of Cistercian nuns (Trappistines), numbering about 4,000. A novitiate with each monastery safeguards its independence. An annual general chapter and an abbot-general govern the order. The monks support themselves by manual labor. Current fables concerning Trappist practices, such as the salutation, "memento mori," and daily gravedigging, have probably arisen from the reputation of this order for leading the strictest life in the history of monasticism. They observe perpetual silence.

TRAP ROCK, a comprehensive field name for dark, finely crystalline IGNEOUS ROCKS, mostly of the BASALT and GABBRO groups. The name is from the Swedish *trappar*, referring to the common occurrence of such rocks in step-like sheets. The term trap provides a non-committal name to be applied to those dark colored rocks whose crystallization is so fine as to preclude identification of the individual mineral components without the aid of the microscope. They are typically hard, of high abrasive resistance and good cementing value, and so provide excellent material for road-building.

Traps are common in regions of igneous rocks; the name "Triassic traps" is applied to the basalts and

dolerites of the Newark formation along the Atlantic coast, and the great effusive sheets of lava in India are called the "Deccan traps." *See also* PETROLOGY.

TRAP SHOOTING, shooting at a target thrown from a mechanical device or trap in such a way that it imitates the flight of a game bird. The targets, called clay pigeons, are discs of baked clay. The clay pigeon is placed in an arm of the trap, or, with a double trap, one in each arm. A pull on the trigger releases a spring; the pigeon sails into the air in front of the sportsman, ready with his gun at the firing line. Traps can be adjusted to throw the pigeons at almost any angle and at different speeds. In championship events, the shooters fire from a stand about 25 yards behind the trap which is concealed in a dug-out. The shooter gives the command to pull, the loader releases the trap and the bird sails out to be "killed" or missed. A hit smashes the clay pigeon.

TRAU, Serbo-Croatian **TROGIR**, the Roman *Traurium*, a Yugoslav city near Spalato, close to the Dalmatian coast on an artificial island, which is connected by a turning bridge with the mainland. It completely maintains its medieval aspect, has a beautiful 13th century Gothic cathedral, three abbeys, remains of the Venetian Fort Camerlenghi, and a fine city hall and loggia. The city produces wine, olives, figs and almonds and has fisheries and other industries. Pop. 1931, of municipality, 23,468.

TRAVANCORE, a state in the Madras Agency, British India, stretching along the southeastern extremity of the peninsula and covering an area of over 7,000 sq. mi. The country is mainly mountainous, but along the coast is a strip of sandy country abounding in palms and crossed by innumerable lagoons. Coffee, tapioca, copra, pepper, tea, rubber and timber are produced. Fishing and cotton weaving are the main industries. The capital of Travancore is at Trivandrum. Approximately two thirds of the inhabitants are Hindus and one third Christian. Pop. 1931, 5,090,462.

TRAVEL, BOOKS OF. Travel books have been written and eagerly read since ancient times. Some have been written by explorers and geographers to provide information about new lands; others have recorded the impressions of poets, novelists, philosophers and the like who visit unusual or familiar quarters of the world. Hundreds of books of travel, including minutely descriptive guide books, are published annually, forming an important item in every literature.

Among the ancients, the Greek historian, **HERODOTUS** (d. 424 B.C.), wrote a notable account of Egypt, and the Roman historian, **TACITUS** (1st century A.D.), produced a graphic travel book about savage Germany; the *Description of Greece*, written by Pausanias in the 2nd century A.D., is still valuable. The outstanding medieval traveler was **MARCO POLO** (d. 1324), the story of whose amazing adventures in the Orient were first authentically retold by John Baptist Ramusio in his *Raccolta di Navigazioni e Viaggi*, published about 1550. Hardly less conspicuous was Sir John Mandeville, whose extravagant book of travels ap-

peared in French in 1357-71. Classic travel books were written by the English geographer, RICHARD HAKLUYT, author of *Divers Voyages Touching the Discoverie of America*, 1582. Early in the 17th century SIR WALTER RALEIGH and SIR FRANCIS DRAKE wrote important travel books.

Some of the best books of travel have been produced by men who wrote almost incidentally of their travels as such, BENVENUTO CELLINI, CASANOVA, HEINRICH HEINE and GEORGE BORROW. Of modern travel books, Count Hermann Keyserling's *Travel Diary of a Philosopher*, 1925, has become a classic of its kind.

TRAVELER'S INSURANCE, one of the earliest types of insurance which offered protection to travelers making a voyage by sea or by land. Groups of individuals often undertook to underwrite such a journey even before the establishment of insurance companies. Today, many accident policies have double indemnity clauses providing for increased protection against death or accident occurring on trains, trolleys or passenger boats. Short term policies, issued without medical examination or other qualifications except as to the age limit of the applicant, are sold at railroad stations to cover short trips. *See also* ACCIDENT INSURANCES.

TRAVELER'S-TREE (*Ravenala madagascariensis*), a tree of the banana family, native to Madagascar and grown as an ornamental in many warm countries because of its striking appearance. The palm-like trunk, sometimes 30 ft. high, bears huge banana-like leaves arranged in two ranks at the upper end of the stem imparting to the tree a fanlike aspect. At the base of the leaf-stalks are cuplike enlargements containing a refreshing, watery sap said to be sought after by travelers to allay their thirst. In Madagascar the broad leaves, which rank among the largest borne by any known plant, are used by the natives for thatch to cover huts. The edible seeds are surrounded by a blue pulp which yields an essential oil.

TRAVERSE CITY, the county seat of Grand Traverse Co., Mich., on Grand Traverse Bay at the mouth of the Boardman River, about 150 mi. north of Grand Rapids. It is served by 3 railroads, by bus lines and lake steamers, and has a municipal airport. The Northern Michigan Hospital for the Insane is in Traverse City, which is in the midst of a summer resort region and a large cherry-growing section. The manufactures, amounting in 1929 to about \$3,000,000, include baskets, lumber and wooden dishes. The retail trade in the same year amounted to \$8,600,501. Traverse City was settled in 1842 and incorporated in 1866. Pop. 1920, 10,925; 1930, 12,539.

TRAVERSING. *See* SURVEYING.

TRAVERTINE, a form of calcareous Tufa which, though porous and cellular, is firm and solid enough to be used as an ornamental building stone, especially for walls and flooring. Travertine is a LIMESTONE deposited from springs or streams carrying the calcium carbonate in solution, and is usually white, yellow, gray or brown in color. Mexican ONYX is a banded form of travertine. No commercial deposits of traver-

tine are known in the United States and the stone is chiefly quarried in Italy. *See also* STALACTITE; STALAGMITE; PETROLOGY.

TRAVIATA, LA, an opera in three acts by GIUSEPPE VERDI, libretto based on the younger Dumas's *La Dame aux Camelias* by Francesco Piave; première, Venice, 1853, London, Paris and New York, 1856. Composed in four weeks, it was produced only two months after *Il Trovatore*, and with that opera brings to a close Verdi's earlier melodic style.

Violetta, a Parisian courtesan, is induced by Alfredo Germont to leave the city and become his mistress in his country villa. She consents and takes up her abode with Alfredo. This greatly shocks Giorgio Germont, her lover's father, who comes to her one day and persuades her, for the sake of the family name, to forsake Alfredo. Violetta, concealing the reason for her departure, returns to Paris, and Alfredo, unaware of the woman's sacrifice, denounces her publicly. Later he learns of Violetta's self-sacrifice, and hurries to her bedside to be forgiven by his former mistress. He finds her dying of consumption.

TRAWLER. *See* SHIPS, TYPES OF.

TREASON, in the United States, is defined in the Constitution and consists only in levying war against the United States, or "in adhering to their enemies, giving them aid and comfort." The Constitution further provides that "no person shall be convicted of treason unless on the testimony of two witnesses to the same overt act or on confession in open court."

TREASURE ISLAND, a story of adventure by ROBERT LOUIS STEVENSON; published 1883. A book of pure adventure, written by a man who never lost his sense of the wonder and excitement of boyish day-dreams, it tells the story of Jim Hawkins, the young son of an 18th century English inn-keeper, who discovers that a fierce guest at the inn, Billy Bones, is a pirate. When the pirate dies, Jim gains possession of a chart, and guided by this he goes treasure-hunting with Dr. Livesey and Squire Trelawney. Their adventures on the desert island, the mutiny led by Long John Silver, the great battle at the fort, Jim's capture by the pirates and, finally, the finding of the treasure, make up a tale that is fascinating to old and young alike.

TREASURY DEPARTMENT, UNITED STATES, under the direction of the Secretary of the Treasury, manages the finances of the national government. The Bureau of the Budget, although in the Treasury Department, is under the immediate direction of the President. The Secretary of the Treasury and his assistants superintend and report annually to Congress the collection of revenues, the granting of funds authorized by APPROPRIATIONS, the keeping of the public accounts, the construction and maintenance of public buildings, and the coinage and printing of money. In addition, the Treasury Department is responsible for the administration of the Coast Guard, the Public Health, Industrial Alcohol, Narcotics and Secret Services. The second ranking member of the Department is the Under-Secretary of

the Treasury, whose office has charge of accounts and deposits, the public debt, research and accounting, and the Federal Farm Loan Bureau. The Fiscal Assistant-Secretary and two other assistant-secretaries complete the list of higher officials of the Department. The Secretary of the Treasury is ex-officio chairman of the Federal Reserve Board, the Federal Farm Loan Board, the United States section of the Inter-American High Commission, Director General of Railroads, and trustee of the Postal Savings and of the Smithsonian Institution. S. C. W.

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TREASURY NOTE, paper money issued by the government instead of by banks. It may be secured or unsecured. Such notes were first issued by the United States Government during the War of 1812. They were not intended to circulate as money, and were returned soon after the close of the war. They were used again from 1837-1844, as well as during the Mexican War, 1846-7, and the panic of 1857. The first of such notes to be issued with the legal tender quality were the GREENBACKS of the Civil War. The Treasury notes of 1890 were issued as a part of the campaign to put silver into circulation, and they too had LEGAL TENDER powers. At present the term Treasury note in the United States refers to government obligations with a maturity of three to five years. The British Treasury note issued during the World War has now been amalgamated with the Bank of England note and is secured by government bonds. See also CERTIFICATE OF INDEBTEDNESS; FIDUCIARY ISSUE. B. H. B.

TREATIES, agreements between sovereign states for the regulation of their relations and intercourse, one with the other. They may be bilateral or multilateral in form. While having a status in municipal law, they are clearly international instruments requiring the consent and approval of both parties. They form a source of international law, and extend to every conceivable relation between states. Although under ordinary circumstances agreement to the terms of a treaty is voluntary, acquiescence may be compelled either through the use of force or the threat of force. The enforcement of treaties is the peculiar function of the courts, especially in the United States. The judges of the state courts are bound by them, and the jurisdiction of the Federal courts is expressly extended to them. C. E. MA.

TREATIES, UNITED STATES. The French and Indian War was concluded by the Continental powers in the TREATY OF PARIS, 1763. The independence of the United States was acknowledged by Great Britain in the TREATY OF PARIS, 1783. Commercial treaties of the formative years of the United States includes the JAY TREATY, 1794, and the TREATY WITH SPAIN, 1795. The War of 1812 was concluded by the TREATY OF GHENT, 1814. The boundaries of the United States were greatly extended by the LOUISIANA PURCHASE, 1803. Florida also was acquired by purchase (see SPAIN, TREATY WITH, 1819). The Oregon

country was divided between the United States and Great Britain in the OREGON BOUNDARY TREATY, 1846. A vast area was acquired by conquest and purchase from Mexico in the TREATY OF GUADALUPE HIDALGO, 1848, which treaty concluded the Mexican War. The GADSDEN PURCHASE, 1853, added a strip of northern Mexico to United States domain. Several treaties with Great Britain, including the Convention with Great Britain, 1818; Lake of the Woods Treaty; WEBSTER-ASHBURTON TREATY, 1842; and SAN JUAN BOUNDARY TREATY, 1871, clarified the definition of the boundary between the United States and Canada. Certain of these boundary treaties also pertain to the CANADIAN FISHERIES DISPUTE; fisheries are also the subject of the NORTH PACIFIC FISHERIES TREATY, 1923, and in part of the TREATY OF WASHINGTON, 1871. The RUSH-BAGOT CONVENTION OF 1817 affected the policing of the Great Lakes boundary. Oriental commerce and immigration was the subject of the CHINESE-AMERICAN TREATY, 1844; the BURLINGAME TREATY, 1868; and the JAPANESE-AMERICAN TREATY, 1854. (See also CHINESE EXCLUSION ACTS; JAPANESE EXCLUSION ACTS.) The Panama Canal was furthered by the CLAYTON-BULWER TREATY, 1850; the HAY-PAUNCEFOTE TREATY, 1901; and the HAY-BUNEAU-VARILLA CONVENTION, 1903. The Spanish-American War was concluded by the TREATY OF PARIS, 1898. The WASHINGTON CONFERENCE of 1921-22 gave rise to several important international agreements. See also DISARMAMENT CONFERENCES. For further information see UNITED STATES, HISTORY OF: The World War and After.

TREATISE, a written exposition of the principles of a subject. It differs from the ESSAY in being more methodically and formally written, although generally with less attention to literary style. The treatise may be of any length, but is ordinarily longer than an essay. An example is Samuel Foote's *Treatise on the Passions, so far as they regard the stage*, 1747; a more recent example is H. L. Mencken's, *Treatise on the Gods*, 1930.

TREATY-MAKING POWER, the constitutional authority to enter into TREATIES or agreements with foreign states. In the United States the treaty-making power is committed to the President and the Senate. The President, by and with the advice and consent of two-thirds of the Senators present when a treaty is under consideration, has the power to make treaties. The Senate ratifies the treaty. The President negotiates it. Under the Constitution, states cannot enter into alliances or treaties, or into agreements with foreign states or another state without the consent of Congress. Treaties are made the supreme law of the land and are binding on the state courts. The judicial power of the United States is extended to treaties. In legal effect a treaty stands on the same basis as a law of Congress. C. E. MA.

TREATY PORTS, cities, in some instances lying inland, which the Chinese government has been required by treaty to open to foreign trade and residence. Foreign merchants are guaranteed certain priv-

ileges as regards taxation, the payments of custom dues and the leasing of land. Certain cities opened voluntarily to foreign trade by the Chinese government have also been called, though inaccurately, treaty ports.

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TREBIZOND. See **TRABZON**.

TREE, SIR HERBERT BEERBOHM (1853-1917) English actor and manager, was born in London, Dec. 17, 1853. He made his stage début there in 1876, and won renown for his performance in *The Private Secretary* in 1884. Until 1896 he was manager of the Haymarket Theatre, London, and produced and appeared in many successful plays. Tree took over the management of Her Majesty's Theatre in 1897, and instituted an elaborate revival of Shakespearean plays in which he took leading rôles. He toured Germany in 1907 and the United States in 1916. He was knighted in 1909. His *Thoughts and After Thoughts*, a volume of essays, was published in 1913. Tree died in London, July 2, 1917.

TREE, a woody plant, usually with a single primary stem, which is called a trunk, and nearly always exceeding a shrub in height. There is no absolute line of demarcation between trees and shrubs, but usually there is no difficulty in deciding a particular case, for most trees have only a single trunk. Their size, however, varies greatly, the smaller ones of the region of timber line being lower than many shrubs. The taller kinds, however, reaching over 300 feet in the California redwood, and perhaps more in some Australian gum trees, are among the largest living things. See **SHRUB**.

TREE CREEPER, a name given to a small plainly colored bird (*Certhia familiaris*) of the Old World and also of North America, because of its habit of climbing about tree trunks in search of insect food. See **CREEPER**.

TREE DUCK, the common name for a genus (*Dendrocygna*) of fresh-water ducks with rather long necks and legs, so called from their habit of perching in bushes and trees. There are some 10 species, ranging from 2 to 3 ft. in length, widely distributed in tropical and subtropical regions. They feed largely upon seeds and grain and nest usually in the hollows of trees or upon the ground. Their note is a hissing gooselike whistle. Two species range northward to the southwestern United States, the fulvous tree duck (*D. bicolor*), with black and cinnamon-colored plumage, and the black-bellied tree duck (*D. autumnalis*), reddish-brown above with black underparts. See also **WOOD DUCK**.

TREE FERNS, the name given to numerous tropical and subtropical ferns with an upright, treelike trunk or caudex bearing at its summit a dense rosette of large, usually much divided leaves (fronds). They belong mostly to the tree fern family (*Cyathecaceae*) embracing numerous species distributed in many parts of the globe. They are usually handsome plants, often 15 to 30 ft. or more high, forming in many

humid regions a striking feature of tropical vegetation. Some species of *Cyathea* exceed a height of 50 ft. The attractive, delicately cut fronds of various tree ferns are often 10 ft. or more long. Among the best known are various species of *Dicksonia*, *Alsophila*, *Cibotium* and *Cyathea*. Several tree ferns are grown in greenhouses for their ornamental foliage.

TREE FERNS, FOSSIL, true ferns of towering habit, of which several genera have been distinguished in the Coal Measures of Germany, France, Brazil, Greenland, and the United States. These were the first fossil plants to draw attention. They were formerly credited with extraordinary dominance in the Carboniferous period, termed the Age of Ferns. At the opening of the present century it was discovered, however, that a large proportion of the supposed fern-leaves so common in coal mines, belong not to ferns at all, but to plants bearing seeds on the tips of their fronds. Their classification as **SEED FERNS** greatly diminished the prominence of the tree fern group.

The great Paleozoic tree ferns were successful and impressive plants with stems 2 ft. in diameter, rising sometimes 60 to 70 ft. to a magnificent crown of spreading compound fronds. In appearance they must have resembled living tree ferns. Structurally, however, especially in the peculiar character of their fruiting, they agree closely with a very different and much more modest modern group. These are the elephant ferns (*Marattiaceae*) of the tropics, consisting of clustered fronds only a few feet high. Modern opinion ranks these unprogressive plants as the dwindled representatives of the noble Paleozoic tree fern stock.

TREE FROG, a name which may properly be applied to many arboreal species which belong to several different frog families. There is, however, one distinct family (*Hylidae*) of tree frogs having some 300 species, members of which are found on every continent. Tree frogs have adhesive discs at the ends of their fingers and toes, which enable them to climb with ease. Many are colored green; others are brownish, and they commonly match their environment so well that it is almost impossible to see them. They may be from 1 to 5 in. long.

A very common species in the United States is the northern tree frog (*Hyla versicolor*), often called the tree toad. It is about 2 in. long, and can change from dark brown to light gray, to blend more closely with its background. It may also be green. During the day it hides in protected spots in the trees, coming out at night to hunt for insects. Then it may be heard chirping loudly. In the spring it goes to the water to breed. The young hatch from the egg as tadpoles.

An interesting tree frog from the family of true frogs is the Javan flying frog (*Rhacophorus pardalis*) which has volplanes stretched on its long fingers and toes.

TREE MALLOW, the common name for woody species of *Lavatera*, a genus of the mallow family,

several of which are grown as ornamentals. The Old World tree mallow (*L. arborea*), native to rocky seacoasts in Europe, is cultivated for its showy purple flowers and ornamental foliage. The California tree mallow (*L. assurgentiflora*), a shrub sometimes 15 ft. high with purple flowers 3 in. broad, is planted in mild climates.

TREE ORCHID, the common name for a very numerous genus (*Epidendrum*) of tropical American orchids which grow as epiphytes upon trees. There are about 500 species, eight of which are native from South Carolina to Florida. A few, as *E. vitellinum*, are grown in greenhouses for their large, brilliantly colored flowers.

TREES, ANCESTRY OF. Considerable is known of the ancestry of most of the common trees of the North Temperate zone through a study of their fossil remains. While it is probable that the trees of the Equatorial zone have as ancient a lineage, comparatively little geological study has been devoted to that region and consequently their story is less well known and much of it remains to be discovered.

The forest trees may be roughly divided into two groups, the coniferous trees with needle-like leaves, such as the pine or sequoia, and the broad leaved hardwoods, such as the oak, chestnut and hickory. Although both have their wood in concentric rings and are hence exogenous, they are not closely related. The conifers as a group are much older and their ancestry extends back many millions of years to mid-Paleozoic times. Their early ancestors all belong to genera long since extinct. It is not until the middle Mesozoic that we encounter familiar modern forms as pines, sequoias and cedars. Somewhat later other modern trees as spruces, firs and hemlock make their appearance. In general, it can be said that their geological history is one showing a gradual spread over all of the great land masses of the Northern Hemisphere and a relatively modern restriction to their present ranges. Perhaps the sequoia is the most striking. Once present on all of the continents except Africa and possibly Australia, and abundant in Greenland and Spitzbergen, it is reduced to two species, the big trees of the fog belt of the western slopes of the Sierra Nevadas and the redwood of the well-watered coastal valleys from southern Oregon to central California.

The broad leaved or deciduous trees all have a similar history, although the details vary with each. Most of them, such as the walnuts, hickories, beeches, oaks, gums, maples, sycamores and tulip trees, make their appearance in the geological record during Upper Cretaceous times and appear to have originated in Asia or the Arctic. They gradually spread over all the northern continents and some even reached the Southern Hemisphere. With the gradual elevation of our modern mountains in late Tertiary times, and the resulting climatic changes, many regions, such as our prairie states, became uninhabitable for many of them. Finally the continental glaciers of the Pleistocene also modified their ranges, in particular exterminating

many of them in the European area where almost continuous mountains and seas prevented them from retreating southward. The result was that many survive in southeastern North America and southeastern Asia which have disappeared in the intervening regions. This is true of the hickory, magnolia, sassafras, tulip tree, sweet gum and tupelo. Others such as the walnut managed to maintain an existence in our West and in the eastern Mediterranean and Caucasus regions. Others as the hazel, birch, hornbeam, alder and linden occur in both Eurasia and North America, but in nearly every case their modern ranges are more restricted than was their former range.

A striking illustration of change is afforded by the Miocene trees found in eastern Washington and adjacent regions in Idaho, Oregon and Nevada before the rising Cascades and Coast Ranges caused the climate to become inhospitable. The fossil remains of at least 25 different species (hickory, chestnut, beech, elm, hornbeam, tulip tree, magnolia, sweet gum, linden, sassafras, persimmon) are found, none of which occur in western North America at the present time, but are represented in eastern North America and eastern Asia. Other trees found fossil there (redbud, sycamore, walnut, horse chestnut) have survived in the West in restricted and more favorable situations along streams or in protected canyon bottoms. E. W. BE.

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TREK, THE GREAT, the exodus north and eastward of the Boers of Cape Colony in 1835-37. Their dissatisfaction with British rule had many counts, but the difference of view toward the natives underlay most of them. The abolition of slavery by the London Government in destroying the Boers' economic organization was the chief cause of objection. Inadequate compensation inefficiently distributed, made the difficulty worse. The British use of native police further emphasized the irreconcilable views concerning the position of the natives. Friction also arose over the use of the Dutch language and over the introduction of British legal administration. Angered by these things which they regarded as intolerable abuses of foreign usurpers, the Boers loaded their personal property in wagons and set off for the wilderness beyond the Orange and Vaal rivers, preferring to face the danger of the great Bantu confederation, then at its height, than to remain under British rule. The independence of the republics which the Boers established beyond the Orange, although recognized by Great Britain under Gladstone, was destroyed after the Boer War, 1899-1901.

TRELAWNY, EDWARD JOHN (1792-1881), English adventurer and friend of PERCY BYSSHE SHELLEY and LORD BYRON, was born at London, Nov. 13, 1792. Entering the navy, he traveled extensively and may have encountered some of the adventures he later described in his self-styled autobiography, *Adventures of a Younger Son*, a romantic work which few accept as a wholly authentic account of Trelawny's life. In 1822 he met Byron and Shelley at Pisa, Italy, and became their constant companion. Following Shelley's

death by drowning on July 8, 1822, Trelawny supervised the cremation of the poet's body on the beach near Viareggio, and snatched the heart from the flames. The next year he accompanied Byron on the ill-fated expedition to free Greece from Turkish rule, and became a lieutenant of Odysseus, leader of the insurgents. Trelawny returned to England, and in 1858 published his *Recollections of Shelley and Byron*, a book of reminiscences which showed strong prejudice against Byron. He died at Sompting, Sussex, Aug. 13, 1881.

TRENAGANA or **TRENGGANU**, a Malay state under British suzerainty, on the eastern coast of the peninsula, between Pahang and Kelantan. It covers an area of 5,500 sq. mi., the surface being mountainous and forest-clad. Kuala, at the mouth of the Trenagana River, is the capital of the state. The inhabitants are engaged in fishing, rice cultivation and silk-weaving. Rubber, dried fish, copra and tin are the exports. Pop. 1921, 153,765.

TRENCH FEVER, an infectious disease which was very common during the war of 1914-1918, but is not known to have occurred at any other time. It is caused by a virus present in the excreta of lice which have fed on patients of the disease. The virus is not transmitted by the bite of the lice, nor is it present in their offspring. Approximately two weeks after infection the patient is suddenly afflicted with severe headache, dizziness, perspiration, and fever. The most characteristic and troublesome symptom is severe pain in the shins, especially the lower portion. This usually does not develop until several days after the initial symptoms. The fever occurs in three forms: a short form of several days' duration, a long form which lasts several weeks, and a recurrent or relapsing form. There is no treatment which shortens the disease, relieves the fever or lessens the shin pains. However, it is never fatal.

TRENCHING, in mining, consists of digging trenches through the soil down to bed rock, to determine the width and length of a known, or suspected ore deposit. The trenches are usually at right angles to the longer axis of the body, and extend from one side to the other. *See also* MINING; METAL; MINE EXPLORATION; PROSPECTING; STRIPPING.

TRENCHING MACHINES, machines for digging trenches. They may be divided into horse drawn ditching plows and power operated machines. The ditching plows are comparatively inexpensive implements which will excavate small trenches. It is necessary to grade the trenches made with them by hand. Power operated machines include the wheel excavator and endless chain excavator types. Both excavate to an accurate grade and no hand work is necessary. The less expensive power machines are used extensively on farm tile drainage. The larger sizes are adapted to contractors' uses.

TRENCH WARFARE, a form of combat which characterized operations in the World War on the western front from Sept. 1914 to Mar. 1918. It assumed the character of **SIEGE OPERATIONS** in a war of

attrition and comparative endurance. Both sides organized defensive areas on extended fronts, with complicated trench systems and formidable obstacles, and defended them by the fire of automatic weapons and artillery. In the attack of such positions, infantry was supported by artillery and other auxiliary means of combat, which silenced enemy fire and enabled attacking troops to advance with a minimum of losses. Full support was possible, however, for a limited advance only, to a line called the normal objective of attack. Troops advancing beyond this line passed from trench warfare conditions to those of open warfare, in which artillery support was diminished and infantry had to depend more on its own weapons. Open warfare was conducted on the same tactical principles as trench warfare, but required a state of morale, the spirit of open warfare, which was generally lacking under trench warfare conditions. The Germans, until the winter of 1916-17, and the Allies for a longer period made the error of pushing their front-line trenches into close contact with the enemy front-line trenches already placed on high, dominating ground. Thus, losses were greatly increased and the peculiar horrors of trench warfare were brought on, without any compensating advantage. This error was carefully avoided by Union and Confederate leaders during the campaigns in Virginia and Georgia in 1864, when the fighting had many of the characteristics of the trench warfare of the World War.

S. C. V.

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TREND, SECULAR. *See* SECULAR TREND.

TRENGGANU. *See* TRENAGANA.

TRENT (Italian *Trento*), a city of northern Italy, formerly belonging to Austria, now the capital of the Italian province of the same name in South Tirol. The old city, Italian in character, was noted for the Council of Trent, 1545-63, held in the church of St. Maria Maggiore, where the portraits of the princes of the Church who participated are still preserved. Noteworthy are also the cathedral—a Romanesque basilica begun in the 11th century—the church of San Pietro, the Capuchin monastery, the citadel, city hall and private palaces. Silk spinning is the chief industry. The city was governed by prince bishops. Pop. 1928, 32,160.

TRENT, COUNCIL OF, an important church council, held in the 16th century, regarded by Roman Catholics as ecumenical in character, the decrees and canons of which have been a chief factor in shaping the doctrine and discipline of the Roman Catholic Church to the present day. At the insistence of the emperor Charles V, who hoped that a general council would serve to counteract the Protestant Reformation, the council was called by Clement VII to meet at Mantua in 1537. The obstructive tactics of Francis I were largely responsible for preventing the meeting of the council in Clement's pontificate. The first meeting was held at Trent, in the Tirol, Dec. 13, 1545,

but no decrees had been passed when in February the council was prorogued. The council was again in session from Oct., 1551, to Apr., 1552, and again from January to September, 1562; the last session was in Dec., 1563.

Matters to be taken under consideration were proposed by the cardinal legates; after discussion by "particular congregations" or commissions of theologians and canonists, they were debated in "general congregation" of the bishops. The "sessions" at which the council made its final decisions were formal gatherings for giving authoritative expression to conclusions already determined. Attendance at the council was small at first, but the final decrees were subscribed to by 215 members. At the first meeting, at which no decrees were passed, proxies were allowed for the German episcopate; but this privilege was granted to no others, and was later withdrawn from the Germans. Voting was by head, not by nations; the membership was predominantly Italian. Of the eminent theologians present the most influential were two members of the Society of Jesus, Lainez and Salmeron. The composition of the council and the circumstances under which it met were such that at no time was there any likelihood that it would free itself from papal control, as had the earlier councils of Constance and Basle; yet its proceedings were marked by no little diplomacy and many of its declarations were the results of carefully considered compromise.

The decisions of the council are contained in decrees, which deal with matters of discipline, and in canons which are concerned with dogma. The decrees are ample warrant for considering the council of Trent as one of the great reforming councils of the Church; many of the abuses against which Luther and others had protested were remedied. The canons clarified the dogmatic teaching of the Roman Church, closed certain matters of speculative theology that had been open to discussion in the Middle Ages, and made sharper the line of distinction between the teachings of the Roman Catholic Church and those of the Reformed churches. The Profession of the Tridentine Faith or Creed of Pius IV, to which assent is generally required of converts to Roman Catholicism, is the Nicene Creed together with 8 articles containing a short summary of the Tridentine decisions and 3 more dealing with the authority of the papal see. While the council did not heal the breach in Christendom made by the Lutheran revolt, it was a powerful instrument in the Counter-Reformation and a turning-point in the development of the policy and teaching of the Roman Catholic Church. A. H. S.

TRENT AFFAIR. Capt. Charles Wilkes, commanding the American war vessel *San Jacinto*, on Nov. 8, 1861 intercepted the British mail steamer *Trent* off Havana, and arrested and removed two envoys from the Confederate Government, Mason and Slidell, bound for London and Paris. The commissioners were transported to Boston and confined as prisoners of war in Ft. Warren. The American press and public were jubilant, viewing the action as re-

dress in kind for British unfriendliness; Congress voted Wilkins a resolution of thanks. In England popular indignation meetings were held. The British Government dispatched troops and ammunition to Halifax, and made formal demand upon the United States for reparation. President Lincoln and Secretary of State Seward, aware that the action of Capt. Wilkes was indefensible, released Mason and Slidell and disavowed the seizure. This compliance was particularly disappointing to the officers of the Confederacy, who had hoped that a more belligerent attitude in Washington would lead England to declare war against the northern states.

TRENTINO. See TIROL.

TRENTON, a manufacturing town in Hastings Co., Ontario, Canada, picturesquely situated at the mouth of the Trent River at the western extremity of the Bay of Quinté, 100 mi. northeast of Toronto. It is a steamboat port, the southern terminus of the Trent Valley Canal System, and is served by the Canadian Pacific and Canadian National railways. Trenton transships the timber, agricultural produce, grain, fruit, iron and limestone of the region, while manufacturing interests center in canneries, cotton and paper mills, silverware and other industries. Pop. 1921, 5,902; 1931, 6,276.

TRENTON, a city in northern central Missouri, the county seat of Grundy Co., situated 100 mi. northeast of Kansas City. Bus lines and two railroads afford transportation. The chief interest of the district is agriculture. The city is a shipping center for grain, also for coal mined in the vicinity. Trenton was founded in 1835. Pop. 1920, 6,951; 1930, 6,992.

TRENTON, the capital city of New Jersey and the county seat of Mercer Co., located on the east side of the Delaware River at the head of tidewater navigation 55 mi. southwest of New York City and 30 mi. northeast of Philadelphia. Its transportation facilities include the Pennsylvania and Reading railroads, electric trolleys, motor buses operating over the Lincoln and other important highways, river, coastwise and ocean-going steamers and barges on the Delaware and Raritan Canal. The city is characterized by broad, shady streets, fine residences, many dating back to Colonial times, parks and churches. Among its many notable public buildings are included the state capitol, the court house, the public library and Federal Building. It is the seat of Saint Francis College and of the state Teachers College, state library, and a number of other large public institutions. It is an important industrial center having a great number of varied manufactures valued in 1929 at approximately \$107,000,000, the most notable of which are pottery and clay products, cable, linoleum and rubber goods. The retail trade in 1929 amounted to \$77,641,627, and the wholesale trade proper, to \$18,513,263.

The first permanent white settlement here occurred in 1679. Trenton derived its name from that of William Trent, an early resident of the district. Occupied alternately during the Revolution by British

and American troops, it was the scene of the decisive **BATTLE OF TRENTON** on Dec. 25, 1776. It was seriously considered as a site for the capital of the United States and Congress met here temporarily in 1784. In 1799 the Federal Government established its temporary seat in Trenton. Chartered as a borough in 1745, it was made the capital of the state in 1790 and incorporated as a city in 1792. Pop. 1920, 119,289; 1930, 123,356.

TRENTON, BATTLE OF, Dec. 25, 1776, an engagement of the **REVOLUTIONARY WAR** which resulted in a decisive American victory. During December Gen. Washington's army was in hopeless retreat before the British force under Gen. Howe. The Continental army had crossed to the west side of the Delaware when Washington, knowing that Howe's army had been unwisely stretched in a long line, resolved to recross the river and attack the British line at its center. Although the Continental army of 6,000 men was supposed to cross the river in three divisions, the night of the 25th was so stormy that only one division, 2,500 troops under Washington himself, made the passage. The force landed nine miles above Trenton, having threaded the ice floes so dexterously that not a man was lost. Marching to the town, the army engaged in a sharp battle with 1,100 Hessians under Col. Rahl. Of this force 100 were killed and the rest taken prisoners; the American loss was four, two men killed and two frozen to death. This brilliant victory restored the morale of the Revolutionists.

TRENT RIVER, the third longest river in England, rising in Staffordshire and flowing 170 mi. in an eastern and northeastern course through the midland country. It joins the Yorkshire **OUSE** to form the **HUMBER**, which empties into the North Sea. Navigation is possible 95 mi. above the confluence with the Ouse and is aided by the system of canals connecting the Trent with other waterways of middle and western England.

TREPTOW or Berlin-Treptow, formerly a suburb of Berlin, since 1920 part of Greater Berlin, seat of the 15th municipal administrative district. On the Spree River it embraces the southeastern part of old Berlin. There are industrial plants and a large municipal park on the river. Pop. 1919, 30,704.

TRESPASS, in law, a form of action at common law to recover damages for an unlawful injury done to the plaintiff by direct force and violence to person or property. In the substantive law, trespass to the person is a direct aggression upon the physical person. Trespass to personal property is an unlawful interference with the possession of land without lawful authority. No damage need be shown, but the person trespassed upon may recover a judgment for at least nominal damages in order to establish his right.

TREVELYAN, GEORGE MACAULAY (1876-), English historian, son of George Otto Trevelyan, and grand-nephew of Thomas Macaulay, born Feb. 16, 1876, and educated at Harrow and Cambridge. Coming from a family of historians, he early

showed his aptitude for historical studies. His books evidence the range of his interests. Among his publications are *England in the Age of Wycliffe*, 1899; *England under the Stuarts*, 1904; *Garibaldi and the Making of Italy*, 1911; *Life of John Bright*, 1913; *History of England*, 1926; and *England Under Queen Anne*, 1931. His writing is characterized by clarity of insight and brilliance of exposition. In 1927 he became Regius Professor of Modern History in Cambridge University.

TREVELYAN, SIR GEORGE OTTO (1838-1928), English historian, was born at Rothley Temple, Leicestershire, July 30, 1838. He was educated at Harrow and Cambridge, spent some time in India in 1862, and on his return in 1865 entered Parliament. He was long an important figure in public life being successively Civil Lord of the Admiralty for two years, Chief-secretary for Ireland, Secretary for Scotland, and later holding office under Gladstone and Rosebery. His *Life and Letters of LORD MACAULAY*, his uncle, in 1876 made his reputation as a historical writer. His other works include, *The Early History of Charles James Fox*, 1880, and *The American Revolution*, 1904. One of his many honors was the Order of Merit bestowed on him in 1911. He died in his home at Northumberland Aug. 16, 1928.

TREVES, SIR FREDERICK (1853-1923), British surgeon, was born in Dorchester. He received his education in London schools and in the London Hospital, where he became surgical registrar. In 1881 he was appointed professor of pathology and in 1885 professor of anatomy in the Royal College of Surgeons, and subsequently entered private practice. He operated upon King Edward VII in 1902 and served various royalties. During the World War he assisted in organizing the various activities of the British Red Cross into effective war service. His contributions to medical literature include his works on surgical anatomy, intestinal obstruction, appendicitis and peritonitis. He was also author of a system of surgery, and co-author with Lang of a dictionary of German medical terms. He also wrote many popular travel sketches. M.F.

TREVES. See **TRIER**.

TREVISO, a city of northeastern Italy, capital of the province of the same name in Venetia, situated on a fertile plain surrounded by well-preserved old walls erected towards the end of the 15th century. It has narrow, winding streets, ancient houses with arcades and painted façades, and many monuments. The most prominent buildings are the Cathedral of San Pietro, originally a 12th century basilica, remodeled into a Renaissance edifice in the 15th century, containing paintings by Titian and others; the Gothic Dominican Church of the 14th century; the 13th century Loggia dei Calvarieri; the Palazzo Pretorio, and the Palazzo del Trecento. Treviso is the seat of a bishop, and has a college and theological seminary, technical institute and school, a scientific society, a museum, and a library with valuable manuscripts and paintings. Metal goods, chemicals, paper

and pottery are produced and there is also a brisk trade. The *Tarvisium* of the early Middle Ages, the city was capital of a duchy under the Lombards, and of a county in the Frankish-German times. Subject to Ezzolini da Romano in the 13th century, it came under the rule of Venice, 1404. It was taken by the French in 1797, later became Austrian, and in 1866 Italian. Pop. 1931, 53,952.

TREVITHICK, RICHARD (1771-1833), British engineer and inventor, was born at Illogan, Cornwall, Apr. 13, 1771. He attended school at Camborne, where he astounded his teachers with his quickness at mathematics. One of his neighbors, William Murdoch, was an assistant of the engineer James Watt, and from the former Trevithick learned the first principles of steam locomotion. In 1797 he became engineer of the Ding Dong mine, near Penzance, where he set up an engine equipped with a plunger pump of his own design, the forerunner of the double-acting water-pressure engine. In 1801 he constructed the first steam locomotive to carry passengers, and in 1804 demonstrated an engine capable of hauling 20 tons. Trevithick also designed rock-boring and breaking engines, steam-dredges and threshers. In 1816 he went to Peru to manufacture mining machinery, and returned to England in 1827, to ask parliament for reward for his work. The reward was not granted, and Trevithick died penniless, at Dartford, Kent, Apr. 22, 1833.

TRIAD, in music, a group of three tones formed on any degree of the major or minor scales. There are three principal triads, on the tonic, dominant and subdominant tones, and four secondary triads, in every scale. The principal triads in every major scale are formed of a major third and a minor third, and the secondary triads of a minor third and a major third, always reckoning upward from the first tone, save for the triad on the seventh degree of the scale, which is composed of two minor thirds. The maximum compass of every triad in the major scale is thus a perfect fifth, save for the seventh triad which has the maximum compass of a diminished fifth. Triads may be considered the heart of harmony in that every common chord is a triad with the root tone added an octave higher. Similarly, chords of the seventh are simply triads with added thirds.

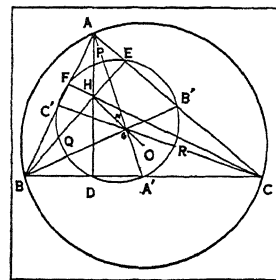
The following triads in the scale of C-major illustrate the construction of triads in all scales:



TRIAL, a judicial examination of the issues between parties to a litigation. Generally, trials are required to be public, but in certain cases courts in their discretion may, in the interests of public morals, or the public safety, exclude specified persons, or even persons generally. At common law trials are held before a court and jury, while in equity, ad-

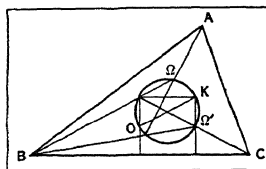
miralty and divorce, trials are had before a judge. In English-speaking countries the cause as a whole is tried by examination and cross examination of witnesses, and production of documents in open court. In countries governed by the modern Roman law, it is more usual to have documents attached to the record before trial of issues and to have different issues tried separately in different ways as prescribed by the court.

TRIANGLE, a polygon of three sides; literally a closed figure having three angles (*tri*, three, + angles). It is the figure of rigidity, for although the sides are hinged at the angles, the figure is rigid. It is therefore the most important geometric element in construction work. Two triangles are always congruent if any three independent parts of one are equal to the corresponding parts of the other, the case of three angles being excluded because the third angle depends for its size upon the other two. One of the most important properties of a triangle is that the sum of the angles is 180° . Among the most interesting of the recent discoveries relating to the triangle are the two stated below.



NINE POINT CIRCLE

The Greeks knew that the three altitudes of a triangle ABC meet in a point, H , and that the three medians of ABC also meet in a point, G . EULER proved that the line HG , the Euler line, passes through the circumcenter O of ABC . Early in the 19th century it came to light that the mid-point N of HO is the center of a circle which passes through (1) the feet of the altitudes of ABC , (2) the mid-points of the sides of ABC , (3) the mid-points of HA , HB , HC . This Nine-point circle was shown by Feuerbach (1822) to touch the inscribed circle and the three escribed circles of ABC .



BROCARD CIRCLE

Within ABC there are two points, Ω , Ω' such that

$$\angle \Omega AB = \angle \Omega BC = \angle \Omega CA$$

and

$$\angle \Omega' AC = \angle \Omega' CB = \angle \Omega' BA.$$

These two Brocard points and O determine the Brocard circle. The diametric opposite, K , of O on this circle is the Lemoine or symmedian point of ABC . Under the impulse given by Lemoine (1840-1912) and Brocard (1845-1922) in the 70's of the last century a great many other remarkable points, lines and circles have since been associated with the triangle. See PYTHAGOREAN THEOREM; POLYGON; PASCAL TRIANGLE.

BIBLIOGRAPHY.—Nathan Altshiller-Court, *College Geometry*, 1925; William Gatty, *Modern Geometry of the Triangle*.

TRIANGULATION. See SURVEYING; also BASE LINE.

TRIANGULUM (gen. *Trianguli*), the northern triangle, a small constellation of fourth magnitude stars between Andromeda and Aries. It contains the famous spiral nebula Messier 33, an island universe 1,000,000 light years distant. See STAR: map.

TRIANGULUM AUSTRALE (gen. *Trianguli Australis*), the southern triangle, a constellation containing one bright reddish star and two slightly less conspicuous ones, forming a triangle, to the south-east of Alpha Centauri. See STAR: map.

TRIANON, TREATY OF, June 4, 1920, a treaty between the Allied and Associated Powers and the "national Government of Hungary," signed in the Grand Trianon Palace, adjoining the Park of Versailles. In the completed document the name of Hungary was substituted for that of Hungarian Republic; but the Allies stated, Feb. 2, 1920, that they would neither recognize nor tolerate the restoration of the Habsburg Dynasty. Peace negotiations were twice delayed, first by the troubled internal situation in Hungary during 1919 and secondly by the refusal of Count Apponyi, head of the Hungarian delegation, to sign the terms as submitted. Upon the resignation of Apponyi, the delegation was reorganized and eventually signed the treaty. The future boundaries of Hungary were announced by the Allies a full year before the treaty was signed, a procedure which drew vigorous but ineffectual protests from the Hungarian delegates.

Every surrounding state gained some of the former Hungarian territory. Yugoslavia obtained Croatia-Slavonia, and part of the Banat of Temesvar; Rumania gained the rest of the Banat, Transylvania and part of the Hungarian plain to the west; to Czechoslovakia went Slovakia and territory south and east of the Carpathians; Austria obtained German West Hungary. Hungary's one outlet to the Adriatic, the city of Fiume, was also lost to her, its fate to be settled by negotiations between Italy and Yugoslavia. Thus Hungary became a small landlocked state with a population of 7,500,000 and an area of only 35,000 square miles. Outside of the new boundaries there dwelt more than 3,000,000 Magyars. The other provisions of the treaty were substantially similar to those of the Treaty of St. Germain, Sept. 10, 1919, between the Allies and Austria. L. G.

BIBLIOGRAPHY.—H. W. V. Temperley, ed., *A History of the Peace Conference of Paris*, vols. 4-5; Hungarian Peace Delegations, *The Hungarian Peace Negotiations*, 4 vols.; D. Jaszi, *The Dissolution of the Hapsburg Monarchy*.

TRIASSIC PERIOD, the first subdivision of the MESOZOIC ERA of geological history. It is so-called because the rocks formed during that period show three types of sediments in Germany, where they were first studied.

TRIBE, a division, class or group of primitive people united into a social or government community. The members of a tribe are ruled by a common chieftain and act as a unit in warfare. They speak a

common language or dialect and frequently regard themselves as descended from a mutual male ancestor.

TRIBES, LOST TEN, the 10 tribes of the Northern Kingdom of Israel which are believed to have been carried away bodily to Assyria after the destruction of the Northern Kingdom and the conquest of Samaria by King Shalmaneser, of Assyria, in 722-721 B.C. In Assyria the Ten Tribes soon disappeared and were lost for all time. According to II Kings 17:6, Shalmaneser carried most of the population of the Kingdom of Israel to Assyria, settling them "in Halah, and in Habor, on the river of Gozan, and in the cities of the Medes." Those Israelites who remained behind in the north, forming the poorer and lower strata of the population, intermarried and mixed with the men of Babylon, Cuthah, Avva, Hamath and Sepharvaim, whom the King of Assyria caused to be brought from the various parts of his kingdom to repopulate the land of Israel (II Kings 17:24). Here the mixed population practiced a form of idolatry (II Kings 17:29-33) together with the worship of God, as a result of which the Jews who returned to Judah under Ezra and Nehemiah some years later refused to admit them to the Jewish community (Nehemiah 2-6). As Samaritans this mixed northern population persisted independently of the Jews, and a handful of their descendants still inhabit Samaria and Nablus (the Biblical Shechem). Later Jewish writings and traditions expressed the hope that the Ten Tribes would some day return, and considered them as still in existence.

Many later legends or fictions gave or confirmed the impression that the Lost Ten Tribes, or individual tribes of the Lost Ten Tribes, were still in existence in after years. Eldad Hadani claimed to be a descendant of the tribe of Dan, and stated that the three tribes of Dan, Naphtali and Asher were still living in Southern Arabia and Ethiopia, where they constituted an independent nomadic Jewish kingdom. DAVID REUBENI, a pseudo-Messiah who appeared at Venice about 1524, claimed to be a lineal descendant of the tribe of Reuben, which formed an independent kingdom in the Khaibar district of Arabia. MANASSEH BEN ISRAEL, in the middle of the 17th century, in his *Hope of Israel*, told the English Parliament that Hebrew-speaking Indians living in the Cordilleras were remnants of the Lost Ten Tribes. Utterly unsubstantiated claims have also been advanced at various times that the Falashas of Abyssinia, the Jews of India, and the North American Indians are each descendants of the Lost Ten Tribes. The Karaites of Russia claimed to be the descendants of these Lost Ten Tribes, and on one occasion declared that they had settled in the Crimea shortly after the time of Shalmaneser in the 7th century B.C. Even to-day some believe the extravagant and wild statement that the British people are descendants of the Lost Ten Tribes (see ANGLO-ISRAELISM), and a serious attempt was made in modern times to prove that the Scythians of old were identical with the Lost Ten Tribes;

or, again, that the Japanese are descendants of the Lost Ten Tribes. However, none of these attempts can be taken seriously, or even semi-seriously.

A. SH.

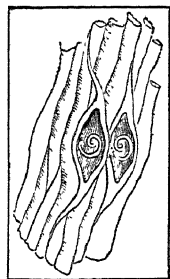
See *Jewish Quarterly Review*, vol. 1, pp. 14-28, 95-114, 185-201, 408-23.

TRIBUNE (Latin *tribunus*). The ten tribunes at Rome formed a college of plebeian officials, sacrosanct in person, elected yearly in the plebeian assembly over which they also presided. They had no civil or military jurisdiction, but were created to defend the rights of the plebeians. Their main weapon was the veto, or right to interfere in elections or deliberations, and prevent a certain action from taking place; but they could also exact fines and exercise a limited amount of coercion.

L. K. B.

TRIBUTE, a periodic payment by one state or prince to another for protection, as a price of peace or as the result of a treaty.

TRICHINA, a species (*Trichinella spiralis*) of threadworm, which causes the disease trichiniasis. It



TRICHINA
Adult encysted in
muscle of pig

is a small internal parasite, found, as an adult, in the intestines of rats, pigs, men and other animals. The female liberates the larvae through the walls of the intestine, and they are carried by the lymph and blood to the muscles of the host, where they encyst. They can become adults only if the first host is eaten by an appropriate second host. Man may become infested by eating raw pork. See also **THREADWORM**; **TRICHINOSIS**.

TRICHINOPOLY, a city in the Madras Presidency, British India, and capital of a district of the same name; situated more than 50 mi. inland on the Cauvery River. The city is celebrated for a fort, within which the Rock of Trichinopoly rises to 273 ft. There is a small temple at the top of the rock. At the foot is the *teppakulam* tank which, together with the rock, is illuminated on great occasions. Trichinopoly is renowned for its cigars and gold jewelry. Pop. 1921, 123,422; 1931, 141,640; district, 1,912,802.

TRICHINOSIS, a disease that develops from the eating of uncooked or underdone pork infected with a parasite known as the *Trichina spiralis*. The larvae are contained in the infected pork. On ingestion, the capsule surrounding the larva is digested, and the larva enters the small intestine. By the third day, the worm is fully grown, and by the sixth day new embryos are fully developed.

During the stage of development of the worm in the intestine there is abdominal pain, vomiting and diarrhea. The embryos migrate into the muscles, producing fever, and swelling and tenderness of the affected muscles. Collection of fluid in the face (**EDEMA**) is an early symptom. With intense infections, the symptoms resemble those of severe **TYPHOID FEVER**. There is fever, delirium, dry tongue, tremor

and rapid pulse rate. Anemia develops in prolonged cases.

The mortality depends upon the degree of infection, varying from 1 to 30 per cent.

In treatment, the intestine should be emptied as quickly as possible after diagnosis is made in order to discharge the worms. No drugs affect the parasites in the muscles. Narcotics may be needed to relieve the pain. Thorough cooking of all pork prevents the disorder. See also **PARASITIC DISEASES**. W. I. F.

TRICHOPTERA, the scientific name for an order of insects known popularly as caddisflies. Their bodies and two pairs of wings are invested in delicate hairs, they are usually dun colored, and generally resemble moths. The larvæ are the interesting aquatic caddis worms, most of which make houses for themselves out of odd bits of debris, held together with silk. The construction is usually tubular, and the insect protrudes its head and legs, dragging the house along when it wants to move. Some species build stationary homes.

TRICLINIC SYSTEM, in **CRYSTALLOGRAPHY**, a system in which minerals are said to crystallize when their faces can conveniently be described by referring them to three imaginary axes of unequal length, intersecting obliquely at the center of the crystal.

TRIER, French *Trèves*, a German city in Rhenish Prussia on the Moselle River close to the boundary of Luxembourg. It is the former capital of the archbishopric and Electorate of Trier. Surrounded by fine parks it has six squares, among them the Chief Market with 15th century houses, a cross erected in 958 and a fountain. Noteworthy among the churches are the Basilica, built by Emperor Constantine the Great, later restored, the splendid Romanesque cathedral which has important relics, including the famous alleged Holy Coat of Christ, the Church of Our Lady, built from 1127 to 1143, the oldest German Gothic church and St. Matthew's with Roman-Christian graves. Interesting monuments of the Roman times are the Porta Nigra, the greatest monument of Roman culture in Germany, an old Roman city gate of the 3rd century, the Roman imperial palace, Roman baths and the remains of a Roman amphitheater. Later buildings of interest are the former archiepiscopal palace, the 10th century Tower of the Franks, the oldest stone dwelling in Germany, and others. Trier has foundries, machine factories, champagne cellars, distilleries, and produces cloth, leather, artificial wool and paint. The trade, aided by the shipping on the Moselle, is chiefly in wine, cattle and lumber. The yearly wine auctions are of great repute. Pop. 1925, 58,140.

TRIESTE, an important seaport at the north-eastern extremity of the Adriatic, formerly the chief port of Austria, but ceded to Italy after the World War, by the Treaty of St. Germain. By special agreement between the two nations, Trieste still handles much Austrian trade. Unlike many Italian cities, it is not surrounded by great agricultural wealth, and the chief product of its countryside is timber, al-

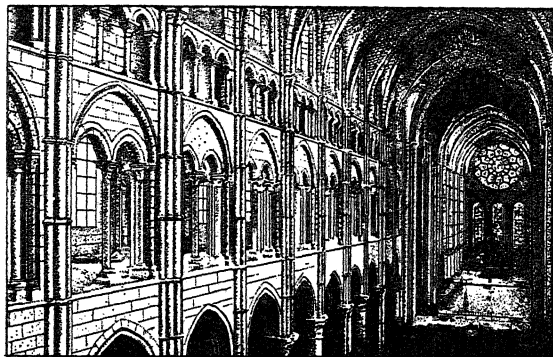
though good wine comes from the district just south. The port is the headquarters of Italian transatlantic steamship lines, with services to North and South America, Egypt, Syria and the Far East. Trieste has large shipyards, foundries, oil refineries, textile mills, chemical works and distilleries. There are steel mills and marble quarries in the suburbs. Pop. 1931, 249,574.

TRIETHANOLAMINE, an alcohol derivative of ammonia, resembling the latter compound and glycerin in its properties. It is a viscous, colorless and practically odorless liquid which is very hygroscopic and completely soluble in water. Its specific gravity is 1.12 at 20° C. and the boiling point is 277° C. at 15 mm. pressure. Triethanolamine is a weakly alkaline material uniting with acids to form salts in accordance with its molecular formula, $(C_2H_4OH)_3H$.

Triethanolamine can be obtained from the reaction products of ammonia with ethylene oxide and is manufactured synthetically from various sources. Its first commercial production occurred in 1927 and it became one of the important new chemicals within a few years.

One of the large uses of triethanolamine is in the manufacture of specialty Soaps for the textile, dry-cleaning and cosmetic industries. It is an interesting emulsifying agent and solvent, and is useful in the purification of industrial and fuel gases. A. L. W.

TRIFORIUM, in Romanesque and Gothic architecture, the arcade or gallery in the walls of a church nave, between the pier arches into the side aisles below, and the clerestory windows above. In some Romanesque and early Gothic churches the triforium



TRIFORIUM OF LAON CATHEDRAL, FRANCE

is a full vaulted gallery, like a secondary upper side aisle, but in the developed Gothic it is either merely an arcade with a passage behind in the thickness of the wall, or a series of openings leading through the wall into the roof space above the side aisle vaults. In the later Gothic all over Europe the triforium tended to disappear altogether. See ROMANESQUE ARCHITECTURE; GOTHIC ARCHITECTURE.

TRIGEMINAL NEURALGIA. See NEUROSURGERY: Brain.

TRIGGER FISH, the name for a numerous family (*Balistidae*) of curious spiny-rayed fishes, allied to the

filefishes, found widely in warm seas. They have a deep, compressed body, rough leathery skin and a very small mouth. The front dorsal fin contains usually three spines, the first of which is much the largest. This is firmly locked when erect by the smaller spine following but may be instantly released and folded back by depressing the third spine, whence the name trigger fish. In the East Indies, where trigger fishes are most common, many species have fantastic markings. For the most part trigger fishes are found along shores feeding upon minute plants and animals. When used for food, which is but rarely, the tough skin is usually stripped off. Many species, however, are considered highly poisonous. The common trigger fish (*Balistes carolinensis*), about a foot in length, is abundant in tropical Atlantic waters, in the Gulf Stream and in the Mediterranean. The slightly larger queen trigger fish (*B. vetula*), of warm Atlantic waters, is common along the coast of Florida. See also FILEFISH.

TRIGLYPH, in classic architecture, the vertical block which separates the METOPES in a Doric frieze. Its exposed face is usually carved with two half vertical grooves on the edges and two whole ones between, hence its name. The triglyph form is usually considered to be a stone reminiscence of the end of a cross beam in primitive wooden construction. The regular spacing of the triglyphs, their position, resting on the architrave, or beam spanning from column to column, and their relation to the MUTULES in the cornice above them, all support this view. In the best Greek Doric work the triglyphs are thick blocks, forming the structural, supporting portion of the frieze, the metopes being mere carved slabs let in between them. In Roman, Renaissance and modern work this distinction is usually lost, the triglyph being treated merely as a rhythmical decoration of the frieze. See ORDER.



TRIGLYPHS ON
FRIEZE OF FAR-
NESE PALACE

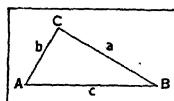


FIG. 1

TRIGONOMETRY, a word meaning triangle measure (Greek *tri*, three, + *gonia*, angle, + *metron*, measure), and hence that branch of MATHEMATICS which shows how to measure completely any triangle, given any three parts, one of which must be a side. For example, if in Fig. 1, we know the measures of *a*, *b*, and *c*, or of *A*, *B*, and any side, or of any two sides of any angle, we can, by trigonometry, find the measures of the other parts.

Since any polygon can be divided into triangles, and any triangle can be separated into two right triangles, the solution, or finding all the measures of the parts of any polygon can be reduced to the solution of the right triangles which together make up the polygon.

Trigonometric Ratios. From the sides of the right triangle *ABC*, conventionally lettered as in Fig. 2,

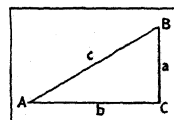


FIG. 2

six trigonometric ratios (*see* RATIO) or FUNCTIONS can be found, viz.:

$$\frac{a}{c}, \frac{b}{c}, \frac{a}{b}, \frac{b}{a}, \frac{c}{a}, \frac{c}{b}.$$

These, together with the relation $a^2 + b^2 = c^2$, commonly called the Pythagorean relation, are the bases upon which trigonometry is built.

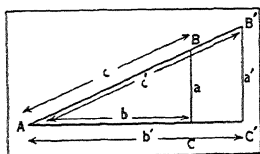


FIG. 3

Since two right triangles are similar if an acute angle of one is equal to an acute angle of the other, then, in Fig. 3

$$\frac{a}{c} = \frac{a'}{c'}, \frac{b}{c} = \frac{b'}{c'}, \frac{a}{b} = \frac{a'}{b'},$$

and so on. From this it is evident that for a given angle each of these six ratios remains unchanged. If, however, the angle A increases to A' , (Fig. 4) $\frac{a}{c}$ is not equal to $\frac{a'}{c'}$, since a' is greater than a , and c equals c' . From these two illustrations it is evident that each

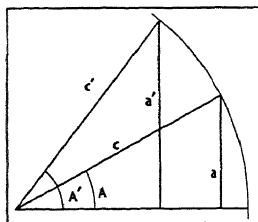


FIG. 4

trigonometric ratio depends on the angle only and not on the length of the sides of the right triangle.

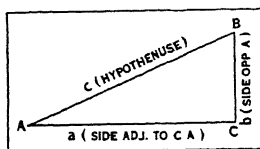


FIG. 5

Since the six ratios mentioned above are of fundamental importance, each ratio is given a name. In Fig. 5, $\frac{a}{c}$ is called $\sin A$, which is read "the sine of A ."

Similarly $\frac{b}{c} = \cos A$, read "cosine of A ," $\frac{a}{b} = \tan A$, read "tangent of A "; $\frac{b}{a} = \cot A$, read "cotangent of A "; $\frac{c}{a} = \sec A$, read "secant of A "; and $\frac{c}{b} = \csc A$, read "cosecant of A ."

From another point of view we look upon the ratios as the definitions of the six names which we have just introduced, thus:

- (1) $\sin A = \frac{a}{c} = \frac{\text{opposite side}}{\text{hypotenuse}}$
- (2) $\cos A = \frac{b}{c} = \frac{\text{adjacent side}}{\text{hypotenuse}}$
- (3) $\tan A = \frac{a}{b} = \frac{\text{opposite side}}{\text{adjacent side}}$
- (4) $\cot A = \frac{b}{a} = \frac{\text{adjacent side}}{\text{opposite side}}$
- (5) $\sec A = \frac{c}{b} = \frac{\text{hypotenuse}}{\text{adjacent side}}$
- (6) $\csc A = \frac{c}{a} = \frac{\text{hypotenuse}}{\text{opposite side}}$

By the aid of geometry it is easy to find the values of the trigonometric functions of certain special angles. In an isosceles right triangle (Fig. 6) whose arms are 1 unit each in length, we have $c^2 = a^2 + b^2 = 2$, whence $c = \sqrt{2}$. Hence

$$\sin 45^\circ = 1/\sqrt{2} = \sqrt{2}/2 = 0.707 \dots$$

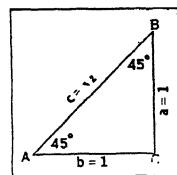


FIG. 6

The value of each of the other five functions of 45° can at once be found.

Similarly in the equilateral triangle ABD (Fig. 7) whose side is 2 units and draw the altitude DC, we know from geometry that $AC = 1$. Whence

$$c^2 = a^2 + b^2 \text{ or } 4 = 1 + a^2, \text{ and } a = \sqrt{3}.$$

From the preceding figures we can make the following table showing the values of the trigonometric functions of 30° , 45° and 60° . Tables computed by means of SERIES, which is a topic in more advanced mathematics, have been compiled giving the values of each of the trigonometric functions for each degree and minute, and also to seconds and a fraction for acute angles.

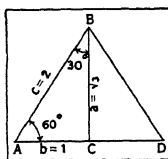


FIG. 7

Angle =	30°	45°	60°
$\sin =$	$\frac{1}{2} = 0.50$	$\frac{1}{2} \sqrt{2} = 0.71 \dots$	$\frac{1}{2} \sqrt{3} = 0.86 \dots$
$\cos =$	$\frac{1}{2} \sqrt{3} = 0.86 \dots$	$\frac{1}{2} \sqrt{2} = 0.71 \dots$	$\frac{1}{2} = 0.50$
$\tan =$	$\frac{1}{\sqrt{3}} \sqrt{3} = 0.57 \dots$	$1 = 1.00$	$\sqrt{3} = 1.73 \dots$

Practical Uses. Trigonometry is a prerequisite to surveying, navigation, engineering, physics, astronomy and in fact to most exact sciences where computing is required. The following practical problem is an illustration of its utility in computation.

Two stations on a level plane are six miles apart. The angle of elevation at one station of a balloon directly over the other is 8° . How high is the balloon?

If we represent the two stations by A and C and the balloon by B in Fig. 8 (not drawn to scale), we have $\tan 8^\circ = \frac{1}{6} BC$, or

$$BC = 6 \tan 8^\circ = 6 \times 0.1403 = 0.843;$$

that is, the height of the balloon is about 0.8 of a mile. The value of $\tan 8^\circ$ is taken from the table of tangents. It is to be observed that the trigonometric functions unite the sides of a right triangle with an angle; thus $\tan A = a/b$ expresses a relation connecting the sides a , and b and the angle A . It is this union of the parts of a triangle

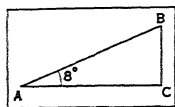


FIG. 8

through the trigonometric functions which gives the subject its great importance in the applications.

While trigonometry had its beginning as a practical method for solving problems relating to the triangle it has, since the 17th century, come to be regarded as the science dealing with the properties of the trigonometric functions and their relationships.

Simple Trigonometric Identities. From the definitions of the six trigonometric functions we can write down the following five relations, which are true for all values of the angle for which each function has a meaning and hence are called identities.

$$(1) \sin A = \frac{1}{\csc A}$$

$$(2) \cos A = \frac{1}{\sec A}$$

$$(3) \tan A = \frac{1}{\cot A}$$

$$(4) \tan A = \frac{\sin A}{\cos A}$$

$$(5) \cot A = \frac{\cos A}{\sin A}$$

The relation $a^2 + b^2 = c^2$ can be written as

$$\frac{a^2}{c^2} + \frac{b^2}{c^2} = 1, \frac{a^2}{b^2} + 1 = \frac{c^2}{b^2}, \text{ or } 1 + \frac{b^2}{a^2} = \frac{c^2}{a^2},$$

and hence we have

$$(6) \sin^2 A + \cos^2 A = 1$$

$$(7) 1 + \tan^2 A = \sec^2 A$$

$$(8) 1 + \cot^2 A = \csc^2 A.$$

These eight identities are the simplest ones of the many which exist among the trigonometric functions.

Spherical Trigonometry. A spherical triangle is a figure on the surface of a sphere formed by three arcs of great circles of the sphere. The solution of the spherical triangle can be effected by the same functions as are used for the plane triangle although the formulas uniting the different parts of the spherical triangle are slightly more complicated. The three

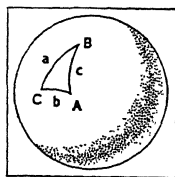


FIG. 9

fundamental equations between sides and angles of a spherical triangle (Fig. 9) are as follows:

$$(1) \cos a = \cos b \cos c + \sin b \sin c \cos A;$$

$$(2) \cos b = \cos c \cos a + \sin c \sin a \cos B;$$

$$(3) \cos c = \cos a \cos b + \sin a \sin b \cos C.$$

Many other relations can be deduced from these three and some are of great importance in geodetic work.

G. W. M.

BIBLIOGRAPHY.—The following books offer a simple introduction to the subject: Mullins and Smith, *Freshman Mathematics*, 1927; Smith, Reeve, and Morss, *Plane Trigonometry*, 1928. For a more advanced text, consult Hobson, *Plane Trigonometry*, 1897.

TRIKKALA, a town in Thessaly, Greece, capital of the nomarchy of the same name. It is a busy commercial center for the Vlach shepherds and the peasant farmers of the region. Its chief products are wheat, cocoons, dairy products and livestock. Pop. 1928, 18,682.

TRILBY, a romance of bohemian life in Paris by GEORGE DU MAURIER; published 1895. Trilby is a model in the Latin Quarter and is in love with a young English artist Little Billee. Soon after refusing to marry because of Billee's parents, she falls under the hypnotic influence of Svengali, a mysterious Jew, and is made by him a renowned concert singer. But when Svengali dies suddenly Trilby loses entirely her musical gift and, the spell now broken, dies miserably. Two minor characters are Taffy, a lovable English giant, and the Scotch "Laird," both friends of Little Billee.

TRILEMMA, a form of disjunctive argument. It is like a DILEMMA except that the disjunctive minor contains three alternatives instead of two. A trilemma is even more difficult to draw than a dilemma; in fact the more the alternants, as in a polylemma, the more difficult is a lemmatic argument to construct. Present-day education in one sense might be said to be in a trilemma. If it is general it gives culture but does not prepare for life; if it is special it trains for a job but does not provide culture; if it is both general and special, it gives only a smattering of culture and does not adequately prepare one for a job in the machine age. But it must be either general, special, or a combination of the two. The conclusion of course implies that in any case it is bound to be a failure.

TRILLIUM, a genus of beautiful, early blooming herbaceous plants of the lily family, several of which are well known woodland wildflowers. There are about 25 species, natives of North America and eastern Asia; of these 17 occur in the United States and Canada most numerous east of the Rocky Mountains. They are smooth, erect, unbranched perennial herbs rising from short, stout rootstocks bearing at the summit of the stem a whorl of three leaves subtending a single sessile or short-stalked flower. Trilliums are readily distinguished by their characteristic flowers composed of three narrow green sepals and

three broader white, pink, purple or sometimes greenish petals. The fruit is a fleshy, many seeded, berry-like capsule.

Among the best known species found in the eastern states are the large-flowered trillium or wake-



LARGE-FLOWERED TRILLIUM

robin (*T. grandiflorum*), with showy white flowers turning pink with age; the ill-scented trillium or birthroot (*T. erectum*), with dark purple flowers emitting a repulsive odor, and the painted trillium or wake-robin (*T. undulatum*), with white, purple-veined, wavy-margined petals and a bright red berry.



FROM JEPSON, MAN. FL. PLANTS CALIF.. COPYRIGHT

WESTERN TRILLIUM
Flowering stem and capsule

Representative species of the Rocky Mountain and Pacific coast regions are the western trillium (*T. ovatum*), with white petals soon changing to deep pink; the brook trillium (*T. rivale*), with white flowers marked with purple, and the giant trillium (*T. chloropetalum*), with large sessile flowers varying from deep maroon to greenish-yellow.

TRILOBITES, a large group of extinct, marine, crablike animals which were exceedingly abundant in early Palaeozoic times. The trilobites, so called from the three longitudinal lobes or main divisions of the body, are related to the stock of the living crustaceans. Fossil trilobite remains are plentiful in Cambrian, Ordovician and Silurian rocks, but decline greatly in the Devonian and the few last survivors are found in the Carboniferous and Permian. Nearly 200 genera and some 2,000 species have been described.

TRIMURTI, in Hindu mythology, the triad of the gods. The triad includes **BRAHMA**, the creator; **Vishnu**, the preserver; and **Siva**, the destroyer and regenerator.

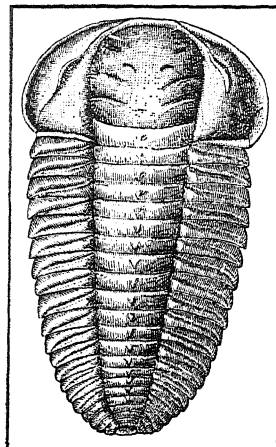
TRINE, RALPH WALDO (1866-), Amer-

ican author, was born at Mt. Morris, Ill., Sept. 9, 1866, and educated at Knox College and at Johns Hopkins University. He served as teacher, lecturer, bank cashier and special newspaper correspondent before becoming a successful author of inspirational books. Trine's best known works are *The Life Books*, 1896-1915, *On the Open Road*, 1908, *The Winning of the Best*, 1912, *My Philosophy and My Religion*, 1921, and *The Power That Wins* (a talk with Henry Ford), 1929.

TRINIDAD, a city in southern Colorado, the county seat of Las Animas Co., situated 85 mi. south of Pueblo. It is served by four railroads. The city is located in an agricultural, stock-raising, and coal-mining region. Railroad shops and a brick and tile factory afford the chief local industrial activities. In 1929 the value of the manufactures was approximately \$2,000,000; the retail trade amounted to \$8,629,595. Trinidad was settled and named by Mexican ranchers in 1853; incorporated as a city in 1877. Pop. 1920, 10,906; 1930, 11,732.

TRINIDAD, the most southerly of the West Indies, separated from South America by the Gulf of Paria, 7 mi. from the coast of Venezuela. Its length is 80 mi., breadth about 54 mi. and total area 1,862 sq. mi. Port of Spain, with a population of about 70,077 in 1931, is the capital.

With the exception of **JAMAICA**, 1,000 mi. farther north, Trinidad is the largest and most valuable of the British West Indies. The coasts are high and rocky on all sides but the west, and the coast scenery is magnificent. The island has three ranges of mountains reaching to a height of 3,000 ft., and as they run parallel to each other they form two extensive valleys, well-watered and extremely fertile, the soil being deep and rich and the climate moist and warm. The sugar lands occupy the rich black



TRILOBITE
Triarthrus becki

reckoned by numbers as "after Trinity," and constitute the "Trinity season." Before the 14th century, Trinity Sunday was kept on various dates. Pope John XXII (1316-34), ordered its present place in the calendar.

TRIOLET, a poem or stanza consisting of eight short lines in which the opening verse is repeated in the fourth and seventh lines, and the second verse in the eighth (A b a A a b A b). The verse-form was invented in France in the latter part of the 13th century and was introduced into England about 300 years later.

TRIPE, the inner lining of the stomach of cattle, cleaned, freed from fat, and scalded. It is boiled until tender, thoroughly chilled and sometimes pickled.

TRIPHENYLMETHANE, an organic chemical compound, which, as its name indicates, consists of methane in which three hydrogen atoms have been replaced by the monovalent phenyl-group, C_6H_5 . It is prepared by the action of benzene upon carbon tetrachloride, or chloroform, by first nitrating it, then oxidizing the resulting nitro-compound. It forms the basis of a large group of synthetic dyes, also called carbonium dyes. Among the dyes based upon it are malachite green, the rosaniline and magenta series, comprising the well-known dye FUCHSINE, and the red dyes of the aurine series.

TRIPLE ALLIANCE, THE, a secret, five-year, defensive, military alliance between Germany, Austria-Hungary and Italy, formed on May 20, 1882, and renewed for continuous periods in 1887, 1891, 1903 and 1912. It expired on May 3, 1915 when Italy resumed her "complete liberty of action" by cancelling the "treaty of alliance with Austria-Hungary."

In 1872 the rulers of Germany, Austria-Hungary and Russia had served notice on the world of their friendship through the formation of a Three Emperors' League. The solidarity of this league, however, was considerably weakened by the conflicting interests of Austria-Hungary and Russia in the Balkans, especially after these conflicts were brought more clearly to the forefront at the CONGRESS OF BERLIN, 1878. At this congress Bismarck attempted to play the rôle of "honest broker"; yet the Russians complained that he showed himself partial to the cause of Austria-Hungary. The accusation was unjust, and Bismarck became quite angry. The league, accordingly, was permitted to lapse, and Bismarck lost no time in approaching the Austrians for a closer and more binding dual agreement.

Germany, in fact, had real cause to worry about Russia's stand. Bismarck was fully aware of the attempts of Prince Gorchakov to flirt with France, and of War Minister Miliutin's program of military preparedness. He also noticed that the Russian cavalry manoeuvres were being carried out much closer to Russia's western border than had been customary, and he was angered by the anti-German attitude of the St. Petersburg and Moscow newspapers. He was not particularly worried about a Russian attack on Germany, but he had no desire to see Russia destroy Austria-

Hungary. He doubtless recognized the possibility that if Austria were broken up, Germany might benefit by the inclusion of the German portions thereof; but he also felt that a dual alliance between Germany and Austria-Hungary would be the best counterweight against a possible Franco-Russian friendship.

Other considerations which appear to have influenced the German chancellor in his decision to seek a binding agreement with the Dual Monarchy were the fact that England and Austria were cooperating harmoniously in their Near Eastern policies, and the fear that Austria, unless definitely allied with Germany, might actually enter into anti-German agreements with France and Russia, as had been the case at the time of the Seven Years' War in the 18th century.

Naturally Bismarck had to fight opposition to his scheme both in Germany and in Austria. For one thing, old Emperor William I was a staunch believer in the value of the traditional friendship with Russia, whose tsar was his nephew. William also feared that if Germany followed any line of action which might be interpreted as anti-Russian, the tsar would be driven into the arms of the French and a Franco-Russian combination against the Germans might be formed. In Austria, Count Andrassy was determined not to enter into any general alliance with Germany, lest England construe this act as a threat to France. Andrassy wanted to maintain England's friendship at all costs. He was ready, therefore, to cement an alliance aimed against Russia, but no more.

Alliance of Germany and Austria. Bismarck had his way against William. The Emperor finally consented to the chancellor's new policy. Against Andrassy, however, Bismarck was unable to make much headway. In Sept. 1879 he visited Vienna amid much pomp and ceremony, and the two statesmen agreed upon a draft alliance which was based directly on Andrassy's views. The document, as finally signed on Oct. 5 and ratified on Oct. 17, provided that if either party were attacked by Russia, or by another power supported by Russia, the other would come to its aid. In all other cases at least a benevolent neutrality would be observed. The terms of this new Dual Alliance were not published until 1888; but their import became known somewhat earlier. Despite his success in this venture Bismarck had no intention of dropping all ties with Russia. In 1881 the Three Emperors' League was revived for a period of three years in written form, and in 1884 its duration was extended for a further stretch of three years.

Meanwhile the kingdom of Italy, anxious to be recognized as a Great Power, was feeling the disadvantages of isolation. Not only was she having tariff difficulties; but in 1881 France secured a protectorate over Tunis, which region the Italians long had hoped to get for themselves. France had been encouraged to take this step at the time of the Congress of Berlin by Bismarck, Disraeli and Salisbury. Bismarck's aim was not so much to create friction between France and Italy as it was to provide France with a balm for the lost provinces of Alsace and Lorraine and to turn the

attention of European diplomats from continental affairs to overseas matters where Germany had nothing to lose. The chagrin of the Italians, particularly of the patriotic but hardly sagacious Premier Cairoli, was unbounded; but the kingdom was impotent against France. Moreover, Italy faced another danger at the moment. Between 1879 and 1881 there were serious complications regarding the status of the papacy. The Pope appeared ready to leave Rome and to seek foreign military aid to regain his temporal power. Once more, therefore, the specter of an Austrian invasion loomed.

In looking for aid Italy now naturally turned to Bismarck, the man who had befriended her in 1866. Bismarck, though willing to listen to the Italian overtures for a treaty, made it clear that the road to Berlin lay through Vienna, for he sensed the opportunity for patching up the Austro-Italian quarrels over "unredeemed Italy," Trieste and the Trentino. Italy took the hint, and negotiations soon were under way for expanding the Dual into a Triple Alliance. Neither Austria nor Germany expected to reap much benefit from Italy's adherence. The Austrians were content merely to feel that they would not have to keep large forces on the Italian frontier in case of war with Russia. Bismarck, similarly satisfied with this prospect, later said in so many words that Italy would remain loyal to the terms of the alliance only so long as it was to her interest to do so.

Italy Joins Alliance. The alliance, as signed on May 20, 1882, stipulated that (1) if Italy were attacked by France without direct provocation, then Germany and Austria-Hungary would render her military assistance; (2) if France attacked Germany without direct provocation, Italy would come to the support of her ally, and (3) if any member of the group were attacked by or at war with two or more nonsignatory Powers, the other two members would come to its aid. With the previous consent of her allies, Italy, on May 22, 1882, issued a declaration to the effect that the treaty could not "in any case be regarded as being directed against England." This reservation was made in view of Italy's long and vulnerable coast line.

Italy, despite her Triple Alliance obligations, signed a secret treaty with France in 1902, promising to remain neutral in case of a German attack upon the republic. She reconciled her action in this instance with her earlier obligations on the ground that the German alliance was purely defensive, and would not be binding in case of a German attack upon France. In 1909 Italy also signed a treaty of similar nature with Russia.

After the formation of the Triple Alliance in 1882, the central European states formed a solid block diplomatically as well as geographically. In all diplomatic negotiations, therefore, this block enjoyed a decided advantage over the isolated Powers, Russia, France and England. Naturally the latter states were quick enough to realize their handicap, and as soon as William II dropped the RE-INSURANCE TREATY OF 1887 with Russia, 1890, the way was opened for a Franco-Russian *rapprochement*. This new feature led eventu-

ally to the formation of the Franco-Russian Alliance of 1894, and then the TRIPLE ENTENTE of 1907. Thereafter Europe was divided into two hostile, powerful, armed camps, each desirous of securing diplomatic victories over the other, each afraid of suffering diplomatic defeats, each anxious to find satellites among the smaller states, and each worried lest the other increase its margin of preparedness or military strength. As a result, Europe was made to experience a series of nerve-racking crises between 1905 and 1914 which could not but end in catastrophe. Each crisis was more difficult of peaceful settlement than the previous one, and the assassination of the Austrian heir-presumptive in June 1914 ignited the powder charge.

When the Triple Alliance was renewed in 1887 Austria-Hungary and Italy had agreed that neither party would seek to secure additional territory in the Balkans without preliminary accord, and that in every case of such addition, the principle of reciprocal compensation should apply. It was on the ground that Austria-Hungary violated this provision in 1914 by sending the ultimatum of July 23 to Serbia without previous consultation with Italy, that the latter first refused to join her allies upon the outbreak of the WORLD WAR and then terminated the entire alliance relationship.

W.C.L.

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TRIPLE ENTENTE, THE, or Entente Cordiale, an alliance or better, a cordial understanding and co-operation between the three great powers, France, Russia and Great Britain in the decade before the WORLD WAR. It gradually became the rival of the TRIPLE ALLIANCE and although no formal treaties were signed between the three powers as was the case with the Triple Alliance, its bonds at the outbreak of the war proved stronger. This does not mean, however, that there were no formal treaties paralleling those of the rival group. Between 1891 and 1894 France and Russia signed political and military agreements of a very definite character. The terms of the military convention were as follows:

"France and Russia being animated by an equal desire to preserve peace, and having no other object than to provide against the necessities of a defensive war provoked by an attack of the forces of the Triple Alliance on one or other of the two, have agreed upon the following provisions:

I. If France is attacked by Germany, or by Italy supported by Germany, Russia will employ all her available forces to attack Germany. If Russia is attacked by Germany, or by Austria supported by Germany, France will employ all her available forces to attack Germany.

II. In case the forces of the Triple Alliance, or of one of the powers composing it, should mobilize, France and Russia at the first news of the event and without any preliminary arrangement being necessary, shall mobilize immediately and simultaneously the whole of their forces and shall move them as quickly as possible to their frontiers.

III. The available forces to be employed against Germany shall be on the side of France 1,300,000 men, on the side of Russia, 700,000 to 800,000 men. These forces shall engage to the full with all speed in order that Germany may have to fight at the same time on the east and west.

IV. The general staffs of the armies of the two countries

will confer at all times to prepare and facilitate the aforesaid agreed on measures. They will communicate (to each other) during the time of peace all information relative to the armies of the Triple Alliance which is or will come to their knowledge. Ways and means of corresponding in times of war will be studied and communicated in advance.

V. France and Russia will not conclude peace separately.

VI. The present convention shall have the same duration as the Triple Alliance.

VII. All the clauses enumerated above shall be kept rigorously secret."

In 1899 this alliance was materially strengthened, says Delcassé in a letter of Aug. 12, 1899 to President Loubet, first by striking out the provision which limited its duration to the existence of the Triple Alliance, and second, by extending its scope so that it applied not merely to the maintenance of peace but just as much to "the maintenance of the balance of power between the European forces." This made the basis for the *causus foederis* broader and, of course, more dangerous. Thus extended, the Dual Alliance between France and Russia was further strengthened by the agreements arrived at in ten military conferences between the chiefs of staffs of the armies of the two countries from 1892 to 1914. The minutes of these conferences were definitely incorporated into the alliance by a provision that they must be submitted to the respective governments for the signature of the prime-minister and the minister of war of both countries.

To these formal military and political agreements was added the naval convention of July, 1912 which provided that "the naval forces of France and Russia shall cooperate in all eventualities where the alliance authorizes and stipulates combined action of the land armies." Plans for cooperation "will be prepared in time of peace" and "the chiefs of staff of both navies shall confer in person at least once a year." As to duration, effectiveness and secrecy, the convention was assimilated to the military convention of Aug. 1892, and the later agreements.

Position of Great Britain. Great Britain's relationship to the Franco-Russian Alliance began early in the century. During the Boer War intense hostility toward England manifested itself in continental countries. This, added to the possibility of a European coalition against England, and Germany's naval program caused much anxiety in the minds of British statesmen. Some of them began to question the advisability of continuing the traditional policy of isolation in the face of the new condition, and a disposition to associate British foreign policy more closely with one or other of the continental groups developed. At first Germany seemed to be the natural ally; France and Russia were at odds with England over a dozen questions in various parts of the world where their colonial interests were involved. As late as 1898, war with France over the FASHODA INCIDENT was narrowly avoided. After that, however, powerful influences began to operate toward more friendly relations. Edward VII ascended the throne in 1901 and soon became a staunch advocate of an understanding

with France toward which certain commercial elements, organized by Thomas Barclay, were also working. The result was the conclusion of four separate agreements in 1904 which served as the basis for the Entente Cordiale.

Of the four treaties, the Declaration respecting Egypt and Morocco signed at London, Apr. 8, 1904, and the secret articles of the same date, is much the most important. It recognized the paramountcy of French interests in Morocco as it did those of England in Egypt, and if occasion should arise the two countries agreed to organize and give mutual support to each other in making desirable reforms in the respective regions.

News of the Entente Cordiale aroused the suspicions of Germany, and led directly into the first Morocco crisis. At the ALGECIRAS CONFERENCE which followed, as in all later international disputes before the World War, France, England and Russia acted in concert. Germany's clumsy efforts to disrupt the Entente resulted rather in its bonds being more tightly drawn with each crisis. In 1907 the triangle was completed in the accord between England and Russia by which these two rivals of more than half a century settled their outstanding disputes in Thibet, Afghanistan and Persia.

Henceforward Europe was divided into two hostile camps, the Triple Alliance and the Triple Entente, with Japan and Portugal in close accord with the Entente powers. Evidence of this soon appeared in the international relations of Europe after 1907, as for example, in the crisis over the annexation of Bosnia and Herzegovina by Austria in 1908, the second Morocco Crisis in 1912 and the strained relations during the Balkan War. Moreover in all but one of the international crises of these years, Italy gave every evidence of being lukewarm in her attachments to the Triple Alliance. This arose out of the fact that in 1902 the long standing controversy with France which began as far back as 1881 over the French annexation of Tunis was adjusted and a secret convention signed in which Italy agreed to support French claims in Morocco in return for French support of Italian plans in Tripoli. In 1909, Italy was drawn still further into the camp of the Entente powers by an accord with Russia known as the Raccognigi agreement by which Russia agreed to Italy's advance in Tripoli in return for Italy's promise of support of Russian policies at Constantinople and the Straits. Warned of the apparent defection of Italy from the Triple Alliance Von Bülow the German Chancellor merely shrugged his shoulders and remarked that "no husband should take offence if his wife had an extra waltz with another partner."

Pre-War Tension. In the meantime the Entente was being strengthened still further by the authorization of the foreign ministers of France and England for conferences between the military staffs of the two countries. In 1911 the two powers came to an arrangement by which France concentrated her fleet in the Mediterranean, Great Britain by implication at

least, agreeing to protect French interest in the Atlantic in case of attack. Following the second Morocco crisis greater precision was given to the understanding by the Grey-Cambon Letters of 1912 in which it was stated, though without the knowledge of the British cabinet, that under certain contingencies the arrangements made by the chiefs of staff would go into operation. In 1914 the Entente was in process of being fully rounded out by a naval accord between England and Russia. All sides of the triangle were therefore doubly strengthened. So far as England was concerned there was no definitive treaty of alliance but the Entente had become none the less an alliance of a subtly binding character because of the moral commitments which, according to Winston Churchill, were quite as strong with an Englishman as were written agreements. During the war the Entente was again strengthened by the Treaty of London and the military and diplomatic cooperation the great conflict called forth.

Of the men intimately associated in the development of the Entente the farseeing and relentless Delcassé, his able ambassador in London, Jules Cambon, the enigmatical Sir Edward Grey, the unscrupulous Isvolsky, the unconsciously yet fanatical Sazonov and the determined, resourceful Poincaré stand out conspicuously. They worked arduously to maintain and strengthen its bonds for the safety of their respective nations. How far they, and with them the Entente, became aggressive in the years immediately preceding the World War, is a subject of much debate. Altogether unexpected and unprecedented light has been thrown on the whole question by the publication of the materials from the Foreign Office Archives.

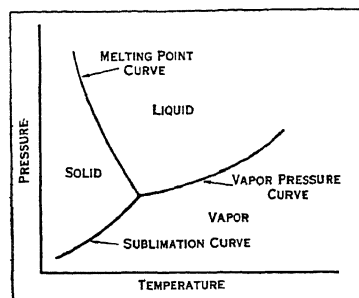
The German documents covering the years from 1871 to 1914 appeared in 40 volumes in the years 1922-26. The first to appear from the Russian archives were published in 1922-23 by René Marchand, a French socialist, who was given admission to the foreign office papers in Leningrad soon after the Russian Revolution. To these have since been added a great many others by the Soviet Government, either in the Krasny archive or in separate form. The British documents began to appear under the editorship of Gooch and Temperley in 1926 under the title *British Official Documents on the Origins of the War 1898-1914*. Austrian documents edited by Bittner and others covering the period from 1908 to 1914 appeared in 1930. The French documents, too, are now in process of being published under the direction of a large governmental commission set up for the purpose. The Italians have announced a plan for an extensive publication of their foreign office documents from 1861 to May, 1915, but as yet nothing has been published. Added to this official material is a constantly increasing mass of material of an unofficial or private character in the form of memoirs and correspondence.

W. E. LI.

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TRIPLE POINT. The pressure of a saturated vapor depends only upon the temperature. A curve drawn on a temperature-pressure chart through the combinations of temperature and pressure for which a liquid and its saturated vapor are in equilibrium, is called the *vapor pressure curve*, or *boiling point curve* for the liquid. A similar curve can be drawn through the combinations of temperature and pressure for which the same substance in solid form is in equilibrium with the saturated vapor when no liquid is present. This is called the *sublimation curve*. As melting point, i.e., the temperature at which the liquid and solid forms of the substance are in equilibrium, is influenced to some extent by the pressure, a third line—the *melting point curve*—can be drawn through the combinations of temperature and pressure for which solid and liquid are in equilibrium. It can be shown that the boiling point curve, the sublimation curve and the melting point curve for any substance, e.g., water, must meet in a single point, called the *triple point*. For this one particular combination of temperature and pressure, the solid, liquid and vapor are in equilibrium with each other.



POINT OF INTERSECTION OF THE MELTING POINT, SUBLIMATION AND VAPOR PRESSURE CURVES IS THE TRIPLE POINT

The triple point for water is at $+0.0074^{\circ}\text{C}$. and 4.6 mm. of mercury. Thus if the temperature of a closed glass flask which contains only water, ice, and water vapor is adjusted to 0.0074°C ., the pressure in the flask will be 4.6 mm. Under these conditions no ice will melt or vaporize, no water will freeze or vaporize, no vapor will condense or freeze. Or, more accurately, although all these processes go on continually, they exactly balance each other, so that the total amounts of ice, water and vapor remain unchanged. In other words, at its triple point, water boils and freezes at the same temperature.

W. W. S.

TRIPOLI, a light, porous, siliceous rock which is produced when WEATHERING has removed the calcareous materials from certain siliceous LIMESTONES or calcareous CHERTS. It is practically synonymous with DIATOMACEOUS EARTH. Tripoli is used in polishing powders, scouring soaps and filter blocks. Illinois, Missouri and Oklahoma produce it.

by Great Britain in 1816. For administrative purposes they are attached to Cape Colony but there is no form of government on them and there are only about 130 inhabitants.

TRISTAN UND ISOLDE, an opera in three acts, music and libretto by RICHARD WAGNER; première, Munich, 1865, New York, 1866, London, 1882. The story, an old Celtic legend, was adapted from Gottfried von Strassburg's version. Wagner, 46 years old when he composed the work, was at the height of his creative power, producing a score which in emotional glamor has perhaps never been equalled. It was abandoned as too difficult for presentation after 57 rehearsals. Six years elapsed before the masterpiece was accorded production.

Tristan, nephew of King Marke of Cornwall, has slain Morold, an Irish knight who had visited Cornwall to collect tribute for Ireland. In disguise as Tantris, the victor seeks the aid of the Irish princess Isolde, whose healing powers are famous throughout the country, for his wounds from the poisoned sword of the slain Morold, who had been engaged to Isolde. Her anger, upon discovering his identity, gives way to overpowering love as she gazes into the eyes of Tristan. He in turn falls in love with her, but both deem their feeling unreturned. Tristan departs for Cornwall, later returning to seek Isolde's hand in marriage for his uncle Marke. She agrees to return with him to Cornwall. During their voyage, however, Brangane, her maid, prepares a love philter, substituting this for the death philter Isolde had ordered. Both drink it, and immediately they realize their real love. To control their actions proves impossible. Surprised by Melot, an ally of King Marke, Tristan permits himself to be wounded in the castle garden, and takes despairing farewell of his beloved Isolde as he is borne away. But the wound which Tristan had invited proves fatal. Isolde arrives to help him, but Tristan tears the bandages from his side and swoons in death while Isolde, falling upon his body, dies from a broken heart.

TRISTRAM SHANDY, "The Life and Opinions Of," a very eccentric humorous work by LAURENCE STERNE; published 1759-67. This whimsical, rambling, discursive "novel" introduced into English fiction some of the drollest characters and situations that have been created before or since the time of Charles Dickens. Among the leading characters are Uncle Toby, with his wild enthusiasm or "hobby-horse" for military affairs, and his self-confessed "amour" with the Widow Wadman; his devoted servant, Corporal Trim—as admirable and as mad as his master; the crude, sleepy, rough-spoken Dr. Slop; Yorick, the rural pastor, who is endowed with a subtle wit; the hero's parents, Mr. and Mrs. Shandy; and, finally, Tristram himself, that prodigy of misfortune, whose birth is so long in coming that the greater part of the book is taken up with the fireside conversation of the principal characters as they sit waiting for the hero to be born. Innocent of any plot, the book depends for its fascination upon Sterne's genius for

comment and his ability to analyse character down to the minutest detail.

TRITON, in Greek mythology a sea divinity, son of POSEIDON and AMPHITRITE. He had the power



TRITON, AS PICTURED ON AN ANCIENT AMPHORA

to calm or stir the waves by blowing on a conch shell. The lower part of his body was a fish's tail. In later legend there were many Tritons.

TRITON, the name of a genus of large tropical sea snails. This conch shell is often called the marine trumpet, because in many lands it has been made into a horn or musical instrument by fitting it with a mouth piece and cutting finger holes. Such trumpets are still used in the South Pacific. The great triton (*Triton tritonis*), which may be as long as 19½ inches, is found in the Gulf of Mexico and the Indian Ocean; a slightly smaller species (*Triton nodiferus*) occurs in the Mediterranean, the eastern Atlantic, and the Indian and Pacific oceans.

TRIUMPHAL ARCH, an ARCH erected for purposes of commemoration. First erected by the Romans as a temporary welcome to a returning conqueror, the triumphal arch was made in permanent material and much used under the Roman emperors. The early examples, as the arches of Augustus at Susa and Aosta, show a wide, comparatively low arch, with a simple use of engaged columns carrying an entablature with an attic above. But later the tendency was towards a greater and greater richness of both sculptural and architectural adornment, and an opening relatively higher, as for example the Arch of Titus, Rome, c. 80 A.D., and the Arch of Trajan at Beneventum. Some of the later examples have smaller arched openings at the sides, as in the arches of Septimius Severus, c. 205, and of Constantine, 312, in Rome. The finest modern examples are the Arc du Caroussel in Paris, by Percier and Fontaine, 1805; the example in Munich, by Gartner & Metzger, 1843-50; the Washington Arch, New York, by McKim, Mead and White, 1895; and unique by its size and beauty, the Arc de l'Étoile, Paris, by Chalgrin, 150 feet wide and 160 feet high, 1805-36. The term is also used of the great arch in a basilica which spans the nave and leads into the crossing of the transepts or into the apse.

TRIUMVIRATE (Latin *triumviri*), the designation of several minor Roman officers charged with inflicting capital punishment, the direction of the mints, assignment of lands to the colonies, and revising the Senate roll. But the most famous were the *IIIviri reipublicae constituendae*, or the second triumvirate

(the first triumvirate of Caesar, Crassus and Pompey in 60 B.C. had no official sanction) of Octavian, Antony and Lepidus in 43 B.C., who had been appointed for five years with proconsular power, the right to issue decrees without confirmation by the senate, to divide up the provinces, issue coins with their own images on them, and hold any office they wished. They also established new colonies, posted proscriptions, levied heavy tributes, named local magistrates. Their power was renewed for a second five-year period, but after the death of Pompey, Lepidus retained only the position of Pontifex Maximus, while Augustus with all the remaining power was ready to embark as emperor. L. K. B.

TROELS-LUND, TROELS FREDERIK (1840-1921), Danish historian, born at Copenhagen, Sept. 6, 1840. As a young man he was influenced by the philosopher, Søren Kierkegaard, whose sister had been the first wife of Troels-Lund's father. At the university he made history his special study, and afterwards held, for five years, a position in the Privy Archives which gave him ample opportunity for research. His first important work was *The History of Denmark and Norway at the End of the Sixteenth Century*. This was a history of the people, their manners, customs, and everyday life rather than of political events. He had intended to write also of the political events of the period, but that part of the work was never completed. Besides several other works on the 16th century, Troels-Lund wrote a history of *Marriage and Morals* in 12 volumes. He died at Copenhagen, Feb. 12, 1921.

TROGON, the common name for a family (*Trogonidae*) of very handsome birds, native chiefly to the American tropics but found also in Africa and Asia. There are about 60 species, mostly medium-sized birds less than a foot long. They have short, strong, hook-tipped bills; long tails sometimes overhung with elongated tail coverts; small, weak feet, and dense brilliantly colored plumage. Somewhat solitary in habit, they frequent the higher trees of the tropical forests, feeding on fruits or insects and uttering low hooting whistles. Trogons fly rapidly, though not for great distances. They make nests in hollow trees or stumps, laying usually three or four white or bluish eggs. The most beautiful of all trogons is the quezal, the national emblem of Guatemala. A single species, the copper-tailed trogon (*Trogon ambiguus*), ranges northward to the United States, reaching the southern parts of Texas, New Mexico and Arizona. It is about a foot long, bright metallic green above and rosy pink below, with a white band on the breast and rich copper-colored markings on the tail. See also QUEZAL.

TROIUS, in Greek mythology the son of PRIAM and HECUBA, or of APOLLO. He was either slain or captured by ACHILLES at the siege of Troy. In medieval legend he was the lover of CRESSIDA.

TROIUS AND CRESSIDA, a play by SHAKESPEARE; produced about 1603. It is based chiefly on Chaucer's *Troilus and Criseyde*. It is at the time of

the siege of Troy, and Troilus, a brave Trojan, is madly in love with Cressida, a beautiful, faithless woman whose uncle, Pandarus, dishonorably furthers the cause of the two lovers. Troilus is tormented by fears and jealous doubts when Cressida, in an exchange of prisoners, is claimed by the Greeks and led over to the enemy's camp by the handsome Diomed. He is driven to despair when he at last learns the full extent of Cressida's licentiousness and utter faithlessness. The minor characters include Achilles and Hector, Ulysses, Ajax, Agamemnon, Nestor and Thersites.

TROLLEY BUS, a passenger vehicle operating without track rails and propelled by one or more electric motors (see MOTOR, ELECTRIC), the power for which is collected from an overhead trackless trolley system. The vehicle is an outgrowth of the street car (see ELECTRIC RAILWAYS) and the Bus, having a rubber-tired body of the street-car bus type, but using electric motors and control as in a street car. Electric return to the generating plant is through a wire, so that the overhead consists of both a positive and negative wire. Swiveling trolley poles permit a touring range of 15 feet to either side of the overhead center. Among advantages are maneuverability on streets, high running speeds, rapid and smooth starting, elimination of track maintenance cost, stopping at curbs, quietness, riding comfort, absence of fumes and low operating and maintenance costs.

At the start of 1932, 16 cities in the United States were operating 230 trolley buses on 189 miles of route, and three cities were about to place 31 vehicles in service on 65 miles of route. During 1931 trolley buses carried 41,179,000 passengers and received \$1,623,000 in revenue. C. A. F.

TROLLING AND SPINNING, a form of angling. Trolling is usually done from a small boat in fresh-water lakes or ponds, although some salt-water fish are caught by trolling. It is also sometimes combined with casting in salt-water surf, where tides and undertow may carry the bait. In trolling from a small boat, it is necessary to move through the water slowly. For pickerel and bass, the spoon is usually trolled on or near the top of the water; but for muskellunge and lake trout, deep trolling is often more successful. The method to be used depends much on the water being fished. In any case, trolling must be done so that the bait moves freely. If artificial bait or spoons are used, the nearer the imitation to the movement of live fish, the better the chances of a catch.

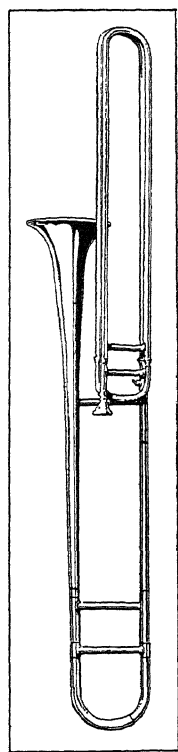
In salt water, bluefish are taken by jigging, which classifies as trolling, since the hook is cast into a shiny lead sinker which, without bait, is pulled rapidly through the water to attract the fish. Spanish mackerel are caught by trolling, which is also the usual way of fishing for tarpon off the Florida coast. On the Pacific Coast, the fighting tuna are also taken by trolling.

TROLLOPE, ANTHONY (1815-82), British author, son of Mrs. Frances Trollope, a prolific novel-

ist, was born in London, Apr. 24, 1815. He had little schooling and his childhood was made unhappy by poverty. In the course of 30 years of capable service in the post-office and after his resignation he wrote more than 50 novels of which the best known are the half dozen volumes of the Barchester series, particularly *Barchester Towers*. Others that have been much read are *The Claverings*, *The Bilton Estate* and *The Vicar of Bullhampton*. Trollope accepted that life practically at its face value, neither attempting to change it nor seeking values that lay deeper than the surface. His books are filled with people who live because the author was a humorist and caricaturist who had a sharp eye for odd quirks in human nature. Many readers are repelled by Trollope's lack of seriousness, but perhaps many more find his gallery of unusual characters as entertaining as that of Dickens. Trollope died at Harting, Sussex, Dec. 6, 1882.

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TROMBONE, a musical wind-instrument of great antiquity, in its primitive forms, and an indispensable part of the brass-choir of the modern ORCHESTRA.



COURTESY M. M. OF ART

TROMBONE

The name is derived from the Italian *tromba*, trumpet, with the suffix *one*, large, and thus literally means "large trumpet." In England it was long known as a sackbut, from the Spanish *sacabuche*, or draw tube, and was a favorite instrument under that title during the reigns of Henry VII and Henry VIII, but the Italian name, except in Germany where it is called a *Posaune*, now prevails generally. Viewed in its physical aspect, it is a brass tube about 9 feet long bent back twice upon itself and terminating at one end in the mouth-piece, at the other in a "bell" whence the tone issues. The middle section of the tube is formed of two parts which slide into each other so as to alter the length of the vibrating air-column, and therefore the pitch. One may disagree with MENDELSSOHN who believed that the trombone "is too solemn an instrument to use except on very special occasions," but there is no disputing the fact that it is capable of majestic effects, although not suited to florid passages. For special effects four trombones, alto, tenor, bass and contra-bass, are used occasionally in

the orchestra; the prevailing usage, however, calls for only three trombones (two tenor trombones in B flat, and one bass trombone in G), the fourth part being supplied by the tuba. The tenor trombone in B flat is treated as a non-transposing instrument and has an

audible compass from E to b' flat, while the bass trombone in G, also treated as a non-transposing instrument, has a compass from C sharp to g'. See OCTAVE for an explanation of this terminology.

TROMP, MARTIN HARPERTZON (1597-1653), Dutch admiral, was born at Brielle, 1597. In 1637 he was created a lieutenant-admiral and two years later defeated the Spanish off Gravelines. As a result of the English Navigation Acts and the disputes over the carrying trade, war between England and Holland broke out and Tromp was given command of the Dutch fleet. In the protracted conflict, Tromp was victor in over 30 sea fights but was finally beaten by the superior equipment and ships of the British. He was killed in a battle with the English Admiral Monk off Trelax, July 1653.

TROMSÖ, a city of Norway, capital of the district of Troms, in 69° 38' N. lat. on Tromsö Island, which is about 6 mi. long and lies in the Tromsöund. It is the seat of a bishop and has advanced schools. Its main buildings are a wooden church, an ethnographic museum, weather observatory and radio station. The chief occupations are shipbuilding, brewing, the extraction of cod liver and herring oil, and the exportation of canned fish, reindeer and sealskins from its excellent harbor. The city was founded in 1794. Pop. 1930, 10,336.

TRONDHEIM, capital of the Norwegian district of Sör-Trøndelag, seat of a bishop and third largest city in Norway, situated on the south coast of the wide fjord of the same name at the mouth of the River Nid. It straggles picturesquely over a number of hills and consists of the city proper and its suburbs Baklandet and Ilen. The harbor has been greatly extended and improved. The climate is mild, producing luxuriant vegetation, and the port is ice-free.

Besides the cathedral, which is the finest church building in Norway, there are other churches, Protestant and Catholic. There are several public buildings on the market place, most of them massive frame structures, among which are the huge edifice in which the king resides when visiting Trondheim, and the new technical university of 1910. The city was once the political center of Norway, but economically it lags far behind OSLO and BERGEN, though it serves as a market for the fertile back country, engages in shipbuilding and the shipping business, with frequent service to all ports on the Norwegian coast.

Olaf Tryggveson laid out the city in 996, calling it Nidaros, City of the Mouth of the Nid. It was destroyed by Jarl Svein, rebuilt by Olaf II, the Saint, and became the residence of the kings of Norway and the seat of an archbishop, 1152-1537. During the last five centuries it burned to the ground 15 times. In 1814 it once more became the official coronation city of Norway. The old name of the city, Nidaros, was restored Jan. 1, 1930, but in Feb. 1931, the Odelsting voted to abolish it and restore the name of Trondheim. Pop. 1930, 54,458.

TROPICAL MEDICINE. Tropical medicine deals with those diseases of man which are either confined to the tropical and subtropical countries or which constitute greater problems in such regions than the same diseases do in temperate regions. **HOOKWORM DISEASE** occurs only in the tropics and subtropics (except for its occurrence in certain mines in temperate regions). On the other hand, amebic dysentery is widespread over the earth, but is a much more important disease in the tropics than in the temperate regions.

The reasons for the limitation of certain diseases to the tropics usually are to be found in the conditions related to the mode of transmission of the diseases from man to man. Thus climate is a distinct delimiting factor in the geographical distribution of hookworm disease, since part of the life-cycle of the hookworm must be spent in warm, moist soil. It is also true that many tropical diseases are transmitted by insects which require the more favorable climate of the tropics for their successful continuous propagation. Such diseases may, however, occur epidemically in temperate regions during the summer months. For example, **YELLOW FEVER** which is transmitted from man to man by certain mosquitoes is endemic only in regions where the mean temperature is not lower than about 78° F., but there are many records of epidemics in colder countries during summer months; similar to the great epidemic in New Orleans and in many Atlantic seaboard cities as far as New York City in 1878.

The importance of tropical medicine can best be understood by the successful building of the Panama Canal which was impossible before the transmission of yellow fever was discovered. Tropical diseases assume such proportions that they greatly impede, if they do not entirely prevent, the reclamation and the industrial development of many tropical countries. In British India alone there are 100,000,000 cases of **MALARIA** annually, with about 1,130,000 deaths from this disease. It is estimated that approximately 800,000,000 people live in the regions of the earth where malaria rages. About 3,000,000 cases occur in the United States annually, and while the death rate in this country is not so high as in the tropics, the economic loss from the debilitating effects of the disease amounts annually to about \$100,000,000.

The greater number of tropical diseases are insect-borne. Of the mosquito-borne diseases, malaria is carried only by certain species of *Anopheles*. Species of the non-anopheline mosquitoes are responsible for the transmission of yellow fever, dengue fever, and filariasis. African sleeping sickness is caused by a minute animal parasite called a trypanosome, and is transmitted by biting-flies slightly larger than house flies, which belong to the genus *Glossina* and are commonly called tsetse flies. Another trypanosome disease which is found in South America, mainly in Brazil, is carried by large bugs belonging to the genus *Triatomina* and related to kissing bugs. **RELAPSING FEVER** may occur in large epidemics in temperate regions in

which it is transmitted by human body lice. Another form of the disease, which may possibly be the more primitive form, is endemic in tropical countries and is transmitted by soft ticks—those which hide in human habitations and come out to bite man only during the night.

There are at least three typhus-like diseases. One is called true **TYPHUS** and is borne by human lice. Another is called Rocky Mountain spotted fever and is transmitted by ticks found in the open fields and woods at altitudes of 3,000 to 4,000 feet. The disease is especially deadly in the Bitter Root Valley of Montana. A third type of typhus is found in Japan and is transmitted by mites. It is called Japanese River Fever or Tsutsugamushi Disease. Recent discoveries indicate that these typhus-like diseases are more widespread than formerly believed. **PLAGUE** occurs sporadically all over the world, but is most prevalent in warm countries. This is a disease of rats and certain other rodents which may be accidentally transferred to man by the bite of infected rat-fleas. Small sandflies are responsible for carrying two diseases: **SANDBLY** (or Pappataci) **FEVER** and oriental sore. It has recently been shown that yaws, which is confined to warmer countries, may be transmitted by certain small flies.

Another group of diseases prevalent in the tropics has as its common characteristic the transmission through food or drink. Amebic infections, which occur as amebic dysentery or amebic liver abscess, are contracted through fecal contamination of food or water. **UNDULANT FEVER**, bacillary dysentery, and cholera are, also, food-borne diseases. (See also **DYS-ENTERY**.)

Hookworm disease and schistosomiasis (**BIL-HARZIASIS**), caused by worms, are contracted by contact with soil and water in which the infective larval stages are living.

Besides these diseases there are many diseases in the tropics caused by plant parasites, the **FUNGI**. Inasmuch as poisonous snakes are very common in the tropics the study of venoms and anti-venoms falls into the subject of tropical medicine. See also **PARASITIC DISEASES**. W. H. TA.

TROPIC BIRD, one of a small, distinctly marked family (*Phaethontidae*) of web-footed oceanic birds, related to the gannets and pelicans. It is often called boatswain by sailors and is found in all tropical and subtropical seas, often keeping far from land. It is a handsome bird of medium size with satiny white or pinkish plumage somewhat varied above by blackish markings, and with the two middle feathers of the tail greatly elongated. In flight the birds are strong and rapid, progressing with quick beats of their long wings; they also swim with great ease. Their food consists chiefly of fish upon which they plunge abruptly from above. In crevices in cliffs, among rocks, or in a hollow tree, they lay a single brownish-purple egg.

Among the best known are the red-billed tropic bird, *Phaethon aethereus*, of the tropical Atlantic and Pacific; the yellow-billed tropic bird, *P. lepturus*, of

the eastern coast of North America from Bermuda to the West Indies, occasionally visiting Florida, and the red-tailed tropic bird, *P. rubicaudus*, of the southern Pacific and Indian oceans, sometimes seen in southern California.

TROPICS, in geography, those two parallels of latitude which are drawn in imagination on the surface of the earth at a distance from the equator of nearly $23\frac{1}{2}^{\circ}$. The word is equally used in climatology to denote that part of the earth which is contained between these two lines. The northern parallel is denoted as the tropic of Cancer, the southern one as the tropic of Capricorn.

TROPPAU. See OPAVA.

TROPPAU, CONGRESS AND CIRCULAR NOTE OF, a congress of the Powers of the Allied Courts, called in 1820 at Troppau to consider the revolutions which had broken out in southern Europe. Austria, Russia, Prussia, England and France were represented. Against the protest of England a system of international intervention was determined upon by the reactionary monarchs of Russia, Austria and Prussia for the purpose of suppressing revolutionary movements. England and France were invited to cooperate. The plan and the argument for it are fully set forth in the Circular Note, dated from Troppau, Dec. 8, 1820. Reviewing the Conferences at Troppau it tells of the "feeling of deep indignation, apprehension and sorrow of those who are called upon to guard the tranquillity of nations," over the events in Spain, Portugal and Naples. It claims that "in the face of the dangers which threaten to envelop Europe" . . . "the Powers are exercising an uncontested right in taking common measures in respect to those states in which the overthrow of the government through a revolt, even if it be considered simply as a dangerous example, may result in a hostile attitude toward all constitutions and legitimate governments." On the basis of this doctrine of intervention the reactionary Powers intervened in Naples and Piedmont in 1821, and, assisted by France, in Spain in 1823.

TROSSACHS, THE, in Gaelic, "bristled country," a shallow, narrow, finely-wooded defile in southwest Perthshire, Scotland, about 60 mi. northwest of Edinburgh, extending from Loch Achray to Loch Katrine, and onward, northeasterly, for almost 3 mi. The entire beautiful region is a rugged massing of rocks, mounds, water and luxuriant vegetation, hemmed by the slopes of Ben Venue, 2,392 ft., and the precipitous Ben A'an, 3,827 ft. As the romantic setting of Sir Walter Scott's *Rob Roy* and *The Lady of the Lake*, it is a popular tourist centre.

TROTZKI (BRONSTEIN), LEV DAVIDOVICH (1879-), the son of a Jewish miller, Lev Trozki, born in Elizavetgrad, was educated at the University of Odessa. In 1898 he was exiled to Siberia for revolutionary activity, but escaped to London in 1902 and became affiliated with Lenin and Plekhanov in the *Isra* group. He returned to Russia in 1905 and played a prominent rôle in the revolution of that year as chairman of the council of workmen's

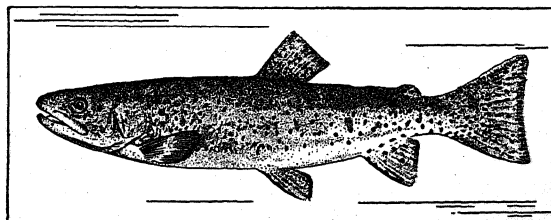
deputies in Leningrad. Arrested and sentenced to Siberia once more, he escaped to Vienna, and engaged in propaganda and journalistic work until 1916, when he was deported from France and became editor of the radical *Novy Mir* in New York.

Upon the outbreak of the Russian revolution in Mar., 1917, Trozki returned to Leningrad and became for the first time a full-fledged member of the Bolshevik party, later being named Bolshevik commissar for foreign affairs, in which capacity he exercised a dominant influence in the negotiations at Brest-Litovsk, though greatly in awe of the German negotiators and the power they represented. He subsequently became commissar for war, and was replaced at the foreign office by George Chicherin. In his new capacity, Trozki earned the chief credit for the creation and organization of the "Red" army as an efficient military force, though the best fighting on the southern front was actually inspired by Stalin. As an individualist disqualified by temperament for faithful and selfless cooperation in a long-range program, he soon came into conflict with Stalin when the latter began to grasp at leadership in the Communist party during Lenin's final illness. As a matter of fact, Stalin knew by experience that in Trozki an imposing front and copious language served only to disguise a futile intellectuality.

After Lenin's death, Trozki was demoted from the war office to various insignificant commissions, and having earned Stalin's hostility by endeavoring to organize a menacing opposition to his economic policies, was expelled from the party in Nov. 1927, and exiled living first in Turkestan and later in Istanbul. S. H. C.

TROUBADOURS, wandering poets of southern France, Italy and Spain, who flourished from the 12th to the 14th century, composing and singing in the *langue d'oc* their songs of love. Usually noblemen, they recited to their own accompaniment, glorified the lady of the castle or by their songs inspired their host's subjects to deeds of loyalty. Their counterparts in northern France were the *trouvères*.

TROUT, a group (*Salmo* sp.; *Salvelinus* sp.) of fresh-water fishes closely allied to the SALMON, embracing many of the finest North American game



BLACK-SPOTTED TROUT (*Salmo mykiss*), A KAMCHATKAN SPECIES

fishes, all highly prized for food. They are mostly of small or medium size and handsome coloration, usually with distinctive spots and markings. There are about 40 species, found in greatest variety and

abundance in western and northern mountain streams. They are among the most active of fishes, swimming with amazing swiftness, ascending rapids with ease, and leaping up small waterfalls. Trout inhabit chiefly cool, clear, swift streams with eddies and deep pools, but thrive also in mountain lakes and ponds, where they seek living prey. They subsist mainly on smaller fishes, crustaceans, worms and insects, which they capture in sudden dashes of arrow-like speed.

Most trout spawn late in autumn, laying numerous eggs in rude nests hollowed in the bottom. There the eggs remain through the winter, hatching early in the spring. Nearly all species are courageous and game; they rise readily to casted bait and fight vigorously when hooked, affording fine sport for the angler.

The brook trout (*Salvelinus fontinalis*), called also speckled trout and American charr, is one of the best known game fishes of the continent. It occurs native from Maine to Iowa and northward to the Arctic and southward in the mountains to Georgia; it has also been widely introduced into streams in the Rocky Mountain region and on the Pacific coast. In length it ranges from about 8 to 18 in. and usually does not exceed 1 or 2 lbs. weight.

The rainbow trout (*Salmo irideus*), so named because of its brilliant coloration, occurs in streams in the Coast Ranges of California, where it grows to a length of about a foot and a weight of 3 lbs. It then descends to the sea where it matures at a weight of 6 or 8 lbs., returning to river mouths as a "steelhead." A very similar species (*S. shasta*), the rainbow trout of most writers and fish-culturists, native to streams in the Sierra Nevada, has been widely introduced into the eastern United States, Europe and New Zealand. Among other important species are the cutthroat trout, the Dolly Varden trout, and the steelhead trout, all of the Pacific coast. The brown trout (*Salmo fario*) and other European species have been naturalized in various parts of the United States. See also LAKE TROUT; STEELHEAD. A. B. J.

TROUT FISHING, a widely practiced sport, since trout under one name or another are found in many European countries and in North America everywhere in and north of the temperate zone. For catching all trout in streams and many in lakes there are two chief methods, wet- and dry-fly fishing. In either, the art lies in casting the fly upstream so that as it floats down it appears like a natural insect. Only experience can teach the sportsman where to find his fish, and only thorough training in casting enables him to place his fly exactly where it must land. The variety of fly most suitable for a locality can often be learned by observing the insects on which the trout of the stream feed.

Rods of 8 to 16 feet long and of half a dozen materials, reels of a score of sizes and designs, and flies of a hundred patterns are available to modern trout fishermen. Tiny spoons and other spinning baits, rubber insects, miniatures of the casting plugs used for bass, and a dozen live baits are also used. The earthworm is a deadly trout bait the world around.

For the huge lake trout of the northern United States and Canada, live and artificial minnows or insects, large spoons and casting plugs of various designs, small frogs and many other baits are used.

See George M. LaBranche, *The Dry Fly and Fast Water*, 1914.

TROUT LILY, a name sometimes applied to the yellow ADDER'S-TONGUE or dogtooth violet, a handsome spring wildflower of the eastern United States with more or less mottled leaves.

TROVATORE, IL, an opera in four acts by GIUSEPPE VERDI, libretto by Salvatore Cammarano; première, Rome, 1853, Paris, 1854, London and New York, 1855. It belongs among the earlier and more melodic of Verdi's operas, and has retained a firm foothold in the standard repertory.

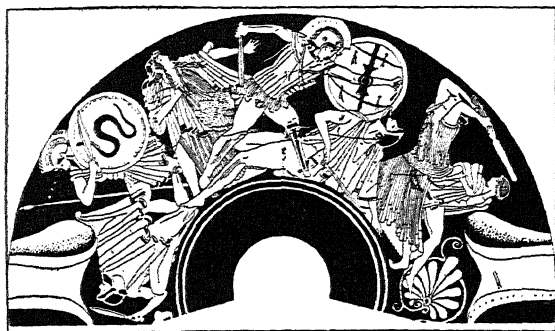
When a child, Garzia, brother of Count Luna, had a spell cast over him by a gypsy. The gypsy was killed in punishment, while her daughter, Azucena, revenges the death of her mother by announcing that Garzia has been burned to death; but she secretly brings him up as Manrico. On reaching manhood, Manrico becomes a troubadour, enters a tournament of song, and is crowned victor by the Princess Leonora. They fall in love, and when Count Luna is caught by Manrico lingering under Leonora's window, the troubadour fights the count and is defeated. Thinking Manrico slain, Leonora enters a convent. Manrico returns to the gypsy camp, but when he hears of Leonora's whereabouts he goes forth to rescue her, being presently captured by Count Luna and imprisoned. Meanwhile Azucena has been accused of murdering the count's brother and is sentenced to death. Manrico attempts to rescue the woman but both are thrown into a dungeon. Offering to marry Count Luna if he will spare the life of her troubadour, Leonora wins Manrico's freedom and goes to the jail to die at his feet from poison which she already had taken. Cheated of his bride, Count Luna demands the execution of Manrico, and drags Azucena to witness it, whereupon Azucena tells him that he has just murdered his brother. At this disclosure the count swoons.

TROWBRIDGE, JOHN (1843-1923), American physicist, was born at Boston, Mass., Aug. 5, 1843. After graduating from the Lawrence Scientific School at Harvard, in 1866, he taught physics at Massachusetts Institute of Technology, in 1880 becoming professor of physics at Harvard, and director of the Jefferson physical laboratory four years later. He followed E. C. Pickering in maintaining that laboratory methods were essential to intelligent instruction in physics. He wrote many original contributions in physics, mainly in the field of electricity, and conducted researches into certain aspects of the Röntgen rays. He was elected to the National Academy in 1878. He died at Cambridge, Feb. 18, 1923.

TROWBRIDGE, JOHN TOWNSEND (1827-1916), American writer, was born at Ogden, Monroe Co., N.Y., Sept. 18, 1827. He attended the Lockport Academy for one session and taught for a year. In

Boston he became a contributor to *The Atlantic Monthly*, edited *Our Young Folks* and wrote over 35 books, most of them for boys. *Darius Green and His Flying Machine* is his best known composition in verse; and *Neighbor Jackwood*, 1857, is one of the first faithful pictures in fiction of New England life. Among other books are *Father Brighthopes*, 1853, *The Drummer Boy*, *Cudjo's Cave* and *My Own Story*, 1903. Trowbridge died at Arlington, Mass., Feb. 12, 1916.

TROY, ILIUM or ILION, an ancient ruined city, celebrated in Homer's *ILIAD*, in Virgil's *AENEID* and in medieval romances as the capital city of the Trojan race. Ilium was founded, according to classical



THE SACK OF TROY

Section of a red-figured kylix, or drinking cup, from Brygos, 5th century B.C., now in the Louvre, Paris

mythology, by Ilus, the son of Tros and Callirrhoe, and its famous walls were built by APOLLO and POSEIDON. PRIAM, its fabled king, was the son of Ilus.

Little was known of Troy until 1872-74, when Heinrich Schliemann, excavating at the mound of Hissarlik in Asia Minor, three and one-half miles north of the Hellespont, amazed the entire world by discovering the actual site of the ancient city. His discoveries, later confirmed by Wilhelm Dörpfeld, 1891-94, revealed that Hissarlik had been occupied by nine cities, the earliest dating from about 2200 B.C. and the latest from the beginning of the Christian Era. The sixth of the cities was the Troy described by Homer, and the date of its destruction was probably 1200 B.C.

TROY, a city in southeastern Alabama, county seat of Pike Co., situated about 50 mi. southeast of Montgomery, served by two railroads. Troy is in a highly productive timber and agricultural region. Cotton, corn, peanuts and live stock are the leading products. The local manufactures include fertilizers, crates and veneer. Troy was settled in 1823. It is the seat of a State Teachers College. Pop. 1920, 5,696; 1930, 6,814.

TROY, a city of eastern New York, the county seat of Rensselaer Co., situated at the head of tide-water navigation on the Hudson River, opposite the mouth of the Mohawk River, also on the State Barge Canal, about 6 mi. north of Albany. It is served by three railroads, bus lines, boats and an airport. Through its canal system and the Great Lakes, Troy has direct trade connections with Canada and the

Northwest. The city stands on a narrow plain extending along the river about 7 miles; from this plain rise highlands, where many fine residences are built. Troy produces about 90% of all collars and cuffs made in the United States. A system of laundries originated here for which special machinery has been invented. Other products are shirts and engineering instruments. In 1929 the value of manufactures was about \$44,000,000; the retail trade amounted to \$45,354,821. The city is the seat of the Rensselaer Institute, Russell Sage College, the Emma Willard School and the La Salle Institute. The site of Troy was occupied by Dutch settlers under the Van Rensselaer Manor Grant of 1629. The settlement was incorporated as a village in 1794 and in 1816 was chartered as a city. Pop. 1920, 71,996; 1930, 72,763.

TROY, a city in western Ohio, the county seat of Miami Co., situated on the Great Miami River, 25 mi. northwest of Springfield. Two railroads serve the city; there is also an airport. Troy is a trading center for grain and tobacco, and has airplane, electrical device, furniture and toy factories. Troy was founded in 1807 and chartered in 1890. Pop. 1920, 7,260; 1930, 8,675.

TROYES, a town in northeastern France, capital of the department of the Aube. The treaty of 1420, acknowledging the English King Henry V Regent of France, was signed here, during English occupation. Jeanne d'Arc recaptured the town in 1429. Troyes is a picturesque town and is historically an artistic and commercial center. Its chief industry is hosiery making. Pop. 1931, 58,804.

The Cathedral of St. Peter and St. Paul, begun in the early 13th century, was not completed for more than 300 years. Not sufficiently harmonious to be classed in the first rank of Gothic cathedrals, it is nevertheless notable for its collection of stained glass. Many windows in the choir and chapels are of the 13th century, but most of those in the nave are of the 16th. The triforium is pierced to give place for an extra row of lights. Its nave, choir and transepts form an imposing interior; the façade, added in the 16th century, is inferior. The church of St. Urbain, late 13th and 14th centuries, is another noteworthy example of the local type of developed Gothic. Its extreme lightness of construction and its enormous relative glass area are remarkable.

TROYES, TREATY OF. Having conquered Normandy and the Île de France, and having formed an alliance with Duke Philip of Burgundy, Henry V of England was able to dictate terms of peace to Charles VI. These, embodied in the treaty of Troyes, May 21, 1420, provided for Henry's marriage with Charles' daughter Katherine. While Charles lived Henry was to be Regent of France, succeeding to the throne when Charles died. This disinherited the Dauphin, the future Charles VII. The terms were only imperfectly executed because Henry predeceased Charles, and Henry VI was unable to subdue all France. The English kings continued to bear the title King of France until 1802.

TROYON, CONSTANT (1810-65), French animal painter, was born at Sèvres, Aug. 28, 1810. His father was connected with the manufacture of Sèvres porcelain and Troyon worked as a china decorator until he was 21, when he began to travel about the country painting landscapes. After studying with Roqueplan, who introduced him to the Barbizon landscape painters, Troyon went to Holland where he was much impressed with Paul Potter's *Young Bull*. Between 1850 and 1860 he revealed his power as an animal painter. Among his cattle canvases, which are well known through engravings, are *Oxen at Work* and *Returning to the Farm*, at the Louvre, Paris, and *Watering Cattle* and *Cattle in Stormy Weather*, in the Wallace Collection, London. After a period of mental aberration, Troyon died in Paris, Feb. 21, 1865.

TROY WEIGHT, a system of weight based upon the GRAIN and having a pound of 5,760 grains; used in weighing medicines, precious metals and jewels. This system of weights supposedly originated in the city of Troyes, France; hence, its name; it was adopted in England in the 14th century. When the pound avoirdupois was adopted in the United States in 1832, the pound troy was recognized with the same relation to the pound avoirdupois that it bore in England; viz., $\frac{5,760}{7,000}$.

Table of Troy Weight	
24 grains = 1 pennyweight (dwt)	
20 pennyweights = 480 grains = 1 ounce	
12 ounces = 5,760 grains = 1 pound	

For convenience, in mining, an assay ton, which contains as many milligrams as there are troy ounces in a ton of 2,000 pounds avoirdupois, or 29,167, has been adopted. The number of milligrams of precious metal yielded by an assay ton (see ASSAY) gives directly the number of troy ounces that would be obtained from a ton of 2,000 lbs. avoirdupois.

TRUANCY, a violation of the compulsory education law. This violation is handled usually by the employment of attendance officers as a part of the public school system but nonattendance at school remains a difficult problem in the United States especially in rural communities. The United States census shows that from 6 to 27% of the children between 7 and 16 years are not attending school, the percentage varying according to age. Some communities are employing visiting teachers and utilizing CHILD GUIDANCE CLINICS in an effort to find the underlying social causes of truancy.

TRUCE OF GOD. The Church in the late 10th century took the first steps toward curbing feudal warfare when certain local councils in southern France anathematized all who violated churches or assaulted clergy, women, and merchants. This Peace of God, which aimed to exempt certain classes from the evils of war, being difficult to enforce, new steps were taken early in the 11th century. A Truce of God was declared whereby there was to be no fighting over the weekend beginning Friday. Later efforts attempted

to extend this prohibition to longer periods such as Lent and harvest time. Violators of the truce were excommunicated. Associations for enforcing the peace were formed under episcopal leadership, with courts and militia for punishing offenders. It cannot be said, however, that these methods were particularly effective. The early Capetian kings favored and assisted these efforts, but only with the extension of royal power was feudal turbulence really restrained.

TRUCK, MOTOR, a highway vehicle for the transportation of merchandise and materials. Trucks vary in size from the lighter types for delivering retail goods of small stores to the extra heavy models for transporting loads of great weight. INTERNAL COMBUSTION ENGINES are commonly used to propel the vehicles although a number use storage batteries (see STORAGE CELL) and electric motors (see MOTOR, ELECTRIC). Usually trucks have a platform at the rear of the driver's cab, a platform with stakes or sides, or a fully enclosed body. However, many special types for individual services have been developed, such as tanks for gasoline or milk. When trucks have a pivotal platform over the rear wheels for supporting one end of a semi-trailer they are termed "tractors." Trailers of all kinds are now used extensively with trucks, particularly for long distance runs. Another growing practice is the loading of materials in containers which may be transferred between shipping points and railroad cars by trucks.

C. A. F.

TRUFFLE, the common name for a genus (*Tuber*) of globose sac-fungi. There are many species native mostly to Europe, some of which are edible and like mushrooms highly prized for their agreeable flavor. They grow in groups usually a foot or more below the surface of the soil, chiefly under deciduous trees. The common truffle (*T. cibarium*), with a black, rough surface, abundant in loose soils in central and southern Europe, varies in size from that of a walnut to a potato. In France and Italy dogs and pigs are trained to locate truffles by their scent.

TRUJILLO, a city of Peru, capital of the department of La Libertad, situated near the coast, 325 mi. northwest of Lima. It is the center of a mining and agricultural region. Quantities of sugar, copper, gold and silver are exported. Trujillo, one of the oldest cities of Peru, was founded by Pizarro. Est. pop. 1927, 40,000.

TRUJILLO, a city of southwestern Spain, in the province of Cáceres, situated on the north slope of a hill. It has encircling walls with towers, several old churches, a Moorish citadel and handsome palaces. The city produces earthenware and leather goods; cattle raising is important. In ancient times Trujillo was known as Turris Julia. Trujillo is the birthplace of PIZARRO, whose gravestone is in the Church of Santa Maria de la Concepción. Est. pop. 1929, 11,000.

TRUMBULL, JAMES HAMMOND (1821-97), American philologist, was born at Stonington, Conn., Dec. 20, 1821. He was educated at Yale. Trumbull

was a lifelong student of philology and history and published several noteworthy studies in these fields, including *The Composition of Indian Geographical Names* and *The True Blue Laws of Connecticut*. Also he assisted in editing *Colonial Records of Connecticut*. In 1863 he became president of the Connecticut Historical Society and librarian of the Watkinson Library, Hartford, Conn., both of which offices he occupied until his death at Hartford, Aug. 5, 1897.

TRUMBULL, JOHN (1750-1831), American poet and jurist, was born at Westbury, now Watertown, Conn., Apr. 24, 1750. When seven he passed his entrance examination to Yale, but did not enter until he was 13. While tutoring there he wrote his *Progress of Dullness* as a protest against accepted educational methods. He spent a year in the office of John Adams, Boston, practiced law in Connecticut, held several public offices and became judge of the Supreme Court of Errors. His most famous poem, *McFingal*, is a political satire. Its first part appeared in 1776, the whole in 1782. After the Revolution he and some Hartford friends wrote the *Anarchiad* in support of Federal principles. Trumbull's collected poems were published in 1820. He died at Detroit, Mich., May 10, 1831.

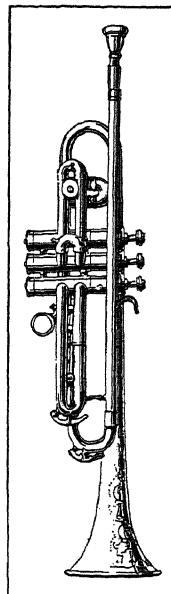
TRUMBULL, JOHN (1756-1843), American painter, was born at Lebanon, Conn., June 6, 1756, the son of Gov. Trumbull of Connecticut. He was graduated from Harvard, served in the forces of Washington and Gates but in 1777 resigned and went to London, devoting himself to art as a profession. He won recognition as the greatest historic painter in America. Among his works are *Declaration of Independence*, *Surrender of Lord Cornwallis*, *Surrender of General Burgoyne*, *Battle of Bunker Hill*, *Death of General Montgomery*, *Battle of Trenton*, *Battle of Princeton* and portraits of Washington and Alexander Hamilton. He was the first president of the Academy of Arts, New York. Trumbull died in New York City, Nov. 10, 1843.

TRUMBULL, JONATHAN (1710-85), American patriot and political leader, was born in Lebanon, Conn., on Oct. 12, 1710, and graduated in 1727 at Harvard. He entered the ministry at Colchester, Conn., but resigned his pastorate in 1731 to practice law. In 1733 he was sent to the general assembly, serving as speaker in 1739. In 1740 he became an assistant to the governor, being reelected annually for 22 years. In 1766 he was appointed deputy governor, and from 1769 to 1783 was governor of Connecticut. At the outbreak of the Revolution he gave his wholehearted support to the patriot cause, and raised troops in excess of his state's quota. According to tradition, he was nicknamed "Brother Jonathan" by Washington. He died at Lebanon, Conn., on Aug. 17, 1785.

TRUMBULL, LYMAN (1813-96), American lawyer and jurist, was born at Colchester, Conn., on Oct. 13, 1813. He was educated at academies, took up law and gained admission to the bar in 1837. He moved to Belleville, Ill., in 1837 and in 1840 was

elected on a Democratic ticket to the state legislature. He was appointed secretary of state in 1841, and served for two years. He sat on the state supreme court bench in 1848-53, and was in the United States Senate in 1855-73. His opposition to the expansion of slavery led him into the Republican party, and he became a strong supporter of President Lincoln. He consistently voted for administration measures during the Civil War, and as chairman of the judiciary committee prepared the draft of the 13th Amendment. In 1872 he joined with the Liberal Republicans in an attempt to defeat Grant for reelection. In 1873 he retired from public life and entered the practice of law in Chicago. Seven years later he reentered politics, but was unsuccessful in his campaign for the governorship of Illinois. He died at Chicago on June 25, 1896.

TRUMPET, a brass wind instrument, generally serving as the soprano part of the brass choir in the modern ORCHESTRA. It is of ancient lineage, being one of the oldest forms of a musical instrument in existence and frequent reference to it may be found in the Bible. Known as the *salpinx* in Greece, it was used during the siege of Troy. The ancient Chinese also made use of the trumpet, the shape of which was almost identical with that of the Roman *lituus*. During the MIDDLE AGES in Europe the trumpet was a generic name that referred alike to the *buccina*; a long straight tube whence issued the trombone, and to the *clarion*, a shorter bent tube whence issued the cavalry trumpet. The modern orchestral trumpet is a conical brass tube from 4½ to 6 feet long, bent back on itself and terminating in a "bell" whence the tone issues. It is furnished with three valves. By means of "crooks," short sections of tubing inserted to increase the length of the tube, trumpets have a variable compass, and some are transposing instruments. The trumpet in F, sounding a perfect fourth higher than the notes written for it, has an audible compass from f to c'', while the trumpet in B flat, sounding a major second below the written notes, has an audible compass from e to b'' flat, and the trumpet in A, sounding a minor third below the written notes, has an audible compass from d sharp to a''. The trumpet in F is used most frequently. The trumpet in C is not a transposing instrument. A trumpet tone is sharper and brighter than that of the trombone and lends an incisive quality to the brasses which is especially effective in dramatic moments. When muted, however, the trumpet is capable of subdued macabresque effects, such as the famous passage for muted trumpets in Richard Strauss's *Till Eulenspiegel*.



COURTESY C. G. CONN

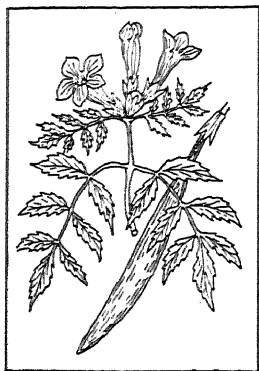
TRUMPET

TRUMPETER, a name often applied to the agami (*Psophia crepitans*), a peculiar bird of South American forest closely allied to the cranes, because of the loud, prolonged, trumpet-like cry of the male. See AGAMI.

TRUMPETS, the name commonly applied in the southern states to large pitcher plants (*Sarracenia* sp.) with long trumpet-shaped leaves. See PITCHER PLANT.

TRUMPET TREE (*Cecropia peltata*), a quick-growing tree of the mulberry family native to tropical America. The hollow stems are often inhabited by certain fierce ants (*Azteca* sp.) which, if the tree is disturbed, rush out and attack the intruder. These ants also protect the tree from the depredations of leaf-cutter ants, a striking example of SYMBIOSIS, that is, the living together of a plant and animal for mutual benefit. The Uaupe Indians made a peculiar kind of musical instrument from the hollow stem.

TRUMPET VINE (*Campsis radicans*), a handsome woody climber of the bignonia family, called also trumpet creeper. It is native to woodlands from



P. A. RYDBERG. "FLORA OF PRAIRIES AND PLAINS"

TRUMPET VINE

southern New Jersey to Iowa, southward to Florida and Texas and widely grown as ornamental. The strong stem, climbing to a height of 20 to 40 ft., bears opposite, pinnately divided leaves and large, trumpet-shaped, scarlet flowers, about 3 in. long. The elongated fruiting pod, 6 in. in length, contains numerous flat seeds with broad transparent wings. Kentucky has adopted the trumpet vine as the state flower.

TRUNKFISH, or boxfish, a group of fishes (*Ostraciidae*) of which there are more than 30 varieties, whose bodies are enclosed in boney cases, formed by six-sided boney scales, closely joined, leaving only the mouth, the end of the tail, and the tips of the fins exposed. Though trunkfish live in shallow waters of tropical seas and are brightly colored, they are protected from their enemies by their armored covering. Ranging in length from 4 to 18 in., they include many odd types. One (*Ostracion gibbosum*) has a pointed spine in the middle of its back. Another (*O. tricornis*) has long horns pointing out over each eye. The majority of trunkfishes have only small dorsal and anal fins and swim slowly. When baked in their shells, they are good to eat.

TRURO, an episcopal city of Cornwall, England, lying in a shallow valley at the junction of the Kenwyn and the Allen, near the estuary of the Fal, about 12 mi. north of Falmouth. Declining as a port after the middle of the 17th century when Falmouth became a rival, it was created an episcopal see in 1876. To-day Truro is a city of broad streets and fine modern buildings, and its cathedral Church of St.

Mary, begun in 1880 and planned in Early English style is an important example of modern ecclesiastical construction. Industries of the locality include tin smelting, and pottery works. Though the harbor is dry at low tide, small vessels may tie up at the quays. Pop. 1921, 10,843; 1931, 11,074.

TRURO, the chief town of Colchester Co., Nova Scotia, Canada, situated on the Salmon River, near the head of Cobequid Bay, about 62 mi. northeast of Halifax. Lying at the center of an agricultural and lumbering district, it is an important junction of the Dominion Atlantic and Canadian National railways. Woolen mills, hat, cap, hosiery and shirt factories and a milk condensary are among the town's numerous industries. Truro is well-built, and contains the county buildings, an agricultural college, the Provincia Normal College and the County academy. In the vicinity is beautiful Victoria Park. Pop. 1921, 7,562; 1931, 7,901.

TRUSS BRIDGE, a type in which the several members are joined into an open framework. The name is usually applied to simple spans extending over several piers, called continuous bridges. When articulated between piers they are called CANTILEVER BRIDGES. In the simple truss span, one or both of the approximately horizontal members or "chords" may be curved. The trusses may have riveted joints or may be connected with "pins," which are large bolts that permit motion. See also BRIDGES.

TRUST, in law, a holding of specific property or of a specific fund or of a power, subject to a duty of employing it or applying its proceeds for the benefit of some one else. By the common law originally the trust was not enforceable, the law regarding only the legal ownership of the trustee and conceiving his duty to be purely moral. From an early date courts of equity enforced the trust, compelling the trustee to use the property for the benefit of the beneficiary according to the terms of the transaction by which the trustee acquired title and the trust was created.

TRUST, INVESTMENT. See INVESTMENT TRUSTS.

TRUST COMPANY, originally a financial corporation, created by a sovereign state, and empowered thereby to perform specified fiduciary services which it would be lawful for a natural person to perform. Each state of the United States has its own laws concerning the creation and supervision of trust companies within its boundaries. Their supervision is entrusted to the banking departments of the respective states. Under provisions of the FEDERAL RESERVE ACT, national BANKS may organize trust departments, and the various state banking laws now provide that state banks may also organize trust departments. There are also a few savings banks which have power to perform trust functions.

The bank of today is really a department store of finance and the trust department is one of the most important parts of nearly every fully developed bank. Broadly speaking, the services performed by trust de-

partments may be classified into two groups; viz., trusts and agencies.

The first general type of trust is a fiduciary relationship in which one person, e.g., the trust company, is the holder of the title to property, subject to an obligation imposed either expressly or by implication of law whereby the obligor is bound to deal with property over which he has control for the benefit of certain persons of whom he may himself be one, and any one of whom may enforce the obligation. These are called personal trusts, because the property which the trustee holds is property of persons or individuals. Such a trust may come into existence through the naming of an executor in a will, the appointment of an administrator of a will, or of an intestate, the appointment of a guardian, the creation of a trust fund through a will, or the creation of a trust fund by a person still living. In general, trusts which arise from the execution of the will of a deceased are called testamentary trusts, while those created by those still living are called living trusts or voluntary trusts. Where the court initiates the appointment of the trustee, it is called a court trust. When acting in the capacity of trustee under any of these circumstances, the trust department of any bank or trust company is responsible to the court.

The second general type of trust is a fiduciary relationship in which one person, e.g., a trust company, is the holder of the title to property, subject to an obligation imposed either expressly or by implication of law whereby the obligor is bound to guard the equitable interests of certain persons, of whom he himself should not be one, against the person or corporation which has under its control the property upon which the equities rest.

These are called corporate trusts because, in general, the property held in title by the trustee is that of corporations. Such a trust agreement is the basis for practically every bond issue and the agreement is called a corporate trust deed. By the terms of this deed, the corporation which desires to make an issue of bonds, makes legal title of property which it is mortgaging over to the trust company in trust for the beneficiaries of the trust agreement. The beneficiaries are the prospective bondholders, and the trust company is trustee for bondholders under corporate trust deed.

J. G. S.

TRUST RECEIPT, a document used in trade transactions in which a bank acts as a creditor for a merchant. In an importation from abroad which a bank has financed, the bank receives the **BILL OF LADING** giving title to the merchandise. The merchant wishing to receive possession of the goods to warehouse them or to dispose of them, signs a trust receipt in order to secure the bill of lading or other documents. The trust receipt is a substitution for collateral and a recognition of the bank's ownership of the goods. It contains a promise to deliver the warehouse receipt or other documents giving title to the goods, or to pay the bank the money it has advanced upon sale of the goods.

TRUSTS, in American usage, monopolistic industrial combinations. The name became current in this sense because the most important early combinations there were put together under a trustee arrangement by which a board of trustees acquired the stocks and properties of existing concerns, issued trustee certificates in exchange, and paid dividends on these certificates from the aggregate earnings of all the concerns. Despite existing disagreements on definitions the conception of trusts formulated by the late Professor H. R. Seager is widely accepted. He stated that a trust is "an industrial combination, not a legal nor a natural monopoly, which seeks to escape the restraints and avoid the wastes of competition by absorbing, controlling, or forcing out of business its would-be competitors, or by acting in concert with them in fixing prices or regulating outputs." Thus somewhat loosely defined, the trust has assumed various forms including at least simple agreements, **POOLS**, **TRADE ASSOCIATIONS**, trustee type combinations, **HOLDING COMPANIES** and outright consolidations. It must be noted that not every trade association, for example, is a trust; the point is simply that trust promoters have used different types of organization. The changes from one type to another have been dictated more by legal than economic reasons. Adverse court decisions caused many trustee type trusts to be remodeled into holding companies.

Among the typical and important trusts organized in the United States were those in the oil, tobacco, steel, sugar, harvesting machinery, shoe machinery, meat packing and cash register industries. The methods by which some of these concerns eliminated their competitors justify the severe censure given them by public and private investigators and by the courts. Furthermore, the huge dividends paid on outrageously watered security issues by some of the trusts make it certain that consumers were being charged extremely high prices for many trust products. And, as might be expected, the political activities of certain combinations were highly reprehensible.

Not all the combinations were financially successful. Probably the most notorious and disgraceful failure was that of the U.S. Shipbuilding Company in 1903. Others have collapsed as completely though not so spectacularly. Statistical evidence establishing the precise degree of the financial success of trusts and of the relative degrees of importance of such factors as economic efficiency and extortionate price policies in attaining that success is inadequate and unsatisfactory or nonexistent. But throughout the western world, particularly in Germany and the United States, the tendency toward cooperative business activity continues, and there has been also a marked recession in the United States from the rigid adherence to the principles of **LAISSEZ-FAIRE** once so common. On the basis of these tendencies it seems reasonable to expect that industrial combinations will form an important part in a society resting not on laissez-faire or monopoly, but on conscious, purposive social control of economic activities.

C. A. G.

TRUSTS, CHARITABLE. See CHARITABLE TRUSTS.

TRUTH, that which squares with fact or reality. Although this is the popular conception of truth it has philosophical difficulties of no small magnitude. It easily leads to a correspondence theory, and like all correspondence theories, must face the problem of knowing when we have and when we have not a fact, or what is real and what is not real. Such words only push the problem back a step farther but do not add to its solution. If the true and false ideas were only labeled, or the facts had some way of making themselves known, it would be a much more simple matter. Most realistic theories of truth are ultimately dependent on some kind of a correspondence relation. It may be between the terms of propositions and their real relationship or between a subsistent and an existent. Idealistic theories also face the problem of conceiving correspondence between ideas and reality. Added to this difficulty they frequently take upon themselves the still more difficult task of finding truth by relating events to the whole of reality. For purposes of orientation there may be some virtue in such a procedure; but the whole of reality is a conception difficult to use concretely in determining what is true. Consistency is often regarded as the criterion for truth. The main difficulty here is that one cannot always be sure of his premises. Consistency is helpful provided the initial premises are sound but if not, this virtue only serves to perpetuate an error. A proposition may be perfectly consistent with a system of false propositions.

The pragmatic theory of truth is often identified with the statement, "A thing is true if it works." This may or may not be true according to the meaning of "work." For the instrumentalist, an idea does not have to correspond to an alien reality. It must simply lead one to an intended reality. This function is a practical one. The idea, instead of being an image, is a tool for controlling the outcome of a given situation. In order to be true it must work in a specific way, i.e., meet the requirements of the problem at hand. R. N. B.

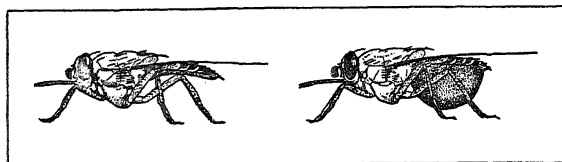
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TRYON, DWIGHT WILLIAM (1849-1925), American landscape painter, was born in Hartford, Conn., Aug. 13, 1849. He studied under Daubigny, Chevreuse and Guillemet in Paris. He became director of the Hartford School of Art in 1882, and later taught at Smith College; in 1891 he was elected to the National Academy. Tryon is known for his poetic interpretation of nature and is represented in the Corcoran Gallery, Washington; Metropolitan Museum, New York; Pennsylvania Academy, Philadelphia; Albright Art Gallery, Buffalo; Detroit Institute of Arts; and elsewhere in America and abroad. The painter died at South Dartmouth, Mass., July 1, 1925.

TRYON, WILLIAM (1725-88), British colonial governor in America, was born in Surrey, England, in

1725. He entered the army at an early age and when 26 was promoted to captain. In 1765 he was appointed governor of North Carolina, where he suppressed the insurrection of the Regulators, 1767-71, and in 1771 was transferred to New York. There he built up a fine body of militia. After the outbreak of the Revolution he commanded a body of Loyalist troops. He was commissioned major-general in 1778, and two years later led a raid into Connecticut. He returned in 1780 to England where he was made a lieutenant-general in 1782. He died in London on Jan. 27, 1788.

TRYPANOSOMES, a group of parasitic one-celled animals that belong to the class of flagellates (*Mastigophora*). They have but one flagellum—a whiplike organ used in locomotion—which, among the blood parasites, is turned backward and joined to the body, forming an undulating membrane. Usually they live as blood parasites in the bodies of fish, amphibians, birds and mammals, and they are carried from host to host by blood-sucking flies and leeches.



TSETSE-FLY (*Glossina morsitans*), TRANSMITTER OF NAGANA DISEASE, BEFORE AND AFTER FEEDING

Some, the lewisi group, are parasitic on a particular species of animal, to which they do not seem to be harmful. Others, the brucei group, though they may be normal parasites on certain animals, can accommodate themselves to various species, and may produce serious pathogenic effects on unusual hosts. For example, one species, *Trypanosoma brucei*, which causes the deadly nagana or tsetse disease to domestic animals like cattle and horses, is thought to be a normal parasite on certain African wild animals. Other serious animal diseases caused by trypanosomes are surra pest and stallion plague. In man pathogenic species give rise to sleeping sickness, schizotrypanosis, kala-agar disease and oriental sore. See also PROTOZOA; SLEEPING SICKNESS, AFRICAN; TSETSE FLY. A. I. W.

TRYPANOSOMIASIS. See SLEEPING SICKNESS, AFRICAN.

TSARSKOYE SELO, formerly the summer residence of the imperial family of Russia, changed by the Soviet Government into a health resort for children. See DYETSKOYE SELO.

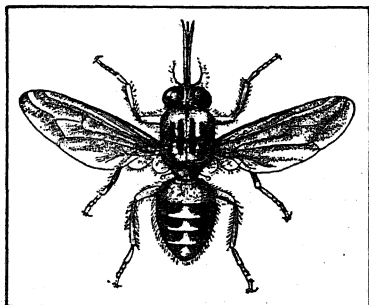
TSCHAIKOWSKY, PETER ILYITCH (1840-93), Russian music composer, was born at Kamso-Votkinsk, May 7, 1840. Intending to pursue a legal career he graduated from law school in 1859 and accepted a civil appointment, but two years later decided to make music his profession. At the age of 22 he entered the St. Petersburg Conservatory, studying under Zarembo and ANTON RUBINSTEIN. Upon graduation he was offered a post in the Moscow

Conservatory, founded in 1866 by Nikolai Rubinstein, and he remained there as professor of harmony until 1877, afterward devoting himself to composition and to conducting his own works. He visited the United States in 1891. An unhappy love affair with the opera singer, Desirée Artot, was followed by his marriage to Antonina Milyukova in 1877, which ended in separation after three months of domestic bitterness. This experience induced a nervous collapse and aggravated his natural melancholy which is one of the prevailing characteristics of his music.

Although Tschaikowsky was modest enough to rank his artistry lower than that of RIMSKY-KORSAKOV, the music world generally reverses that estimate, placing him at the head of Russian composers, especially in the field of symphonic music. Of his dozen operas only *Eugene Onegin* and the *Pique-Dame* are familiar to opera-lovers; but his six symphonies, especially the fourth in F-minor, the fifth in E-minor, and the sixth in B-minor, called the *Pathétique*, are a standard part of the orchestral repertory. His other compositions include five symphonic poems, among them *Romeo et Juliette* and *Francesca da Rimini*; the *Nut Cracker Suite*, three pianoforte concertos, three string quartets, a violin concerto, a number of admirable songs, and several choruses. He also translated François Gevaert's treatise on instrumentation and was the author of a manual of harmony. He died at St. Petersburg (Leningrad), Nov. 6, 1893.

See R. Newmarch, *Tschaikovsky, His Life and Works*.

TSETSE FLY, the common name for a genus (*Glossina*) of blood-sucking flies native to various parts of Africa. There are about 20 species all somewhat larger than the house fly. Because they act as carriers in the transmission of blood parasites (trypanosomes) that cause fatal maladies, tsetse flies rank among the most dangerous of noxious insects. They infest extensive districts known as "fly belts" or "fly country," where they attack warm-blooded animals, especially cattle and horses, and also man. A tsetse fly (*G. palpitans*), found in central and western Africa,



TSETSE FLY
(*Glossina morsitans*). Seen from above,
with wings spread. Enlarged

transmits the trypanosome that produces sleeping sickness; another species (*G. morsitans*), of South Africa, transmits the trypanosome which causes the destructive nagana disease in domestic animals. See also

SLEEPING SICKNESS, AFRICAN; TRYPANOSOMES; TROPICAL MEDICINE.

TSIMSHIAN, a North American Indian tribe; see CHIMMESYAN.

TSINAN also **CHINAN**, a city of China, capital of SHANTUNG province. It is situated in the northern part of Shantung and is the junction of the two main railways which cross the province. Tsinan occupies a position of great economic importance and has been influenced considerably by modern industrial methods. It possesses large flour and cotton mills and is the seat of the Shantung Christian University, which is particularly noted for its medical department. Silks and glassware are the chief manufactures. Tsinan has a great history, having become the capital of Shantung province during the Ming Dynasty, 1368-1644. Pop. about 300,000.

TSINGTAO, Green Island, a strategic military point on the northern coast of China and at one time the center of German operations in the country. It is a well-planned modernized city situated at the entrance of Kiaochow Bay on the southern coast of Shantung province. It has excellent roads, harbor works and railways. Coal mined in the province is distributed from the city. Germany had a 99-year lease on Tsingtao in 1898, an agreement made with the Chinese after two German priests were murdered in 1897 and three warships came from their government to demand retribution. At the beginning of the World War Japan asked for the capitulation of Tsingtao and took it by force on Nov. 7, 1914. Japan occupied the city until 1922 when she returned it to China. Tsingtao's earliest history was as a fishing village. Pop., 1929, 350,464.

TSUSUGAMUSHI DISEASE. See TROPICAL MEDICINE.

TUATARA or **HATTERIA** (*Sphenodon punctatus*), oldest living reptile and sole surviving representative of a virtually extinct order, the *Rhynchocephalia*. Lizard-like in form, the tuatara, nevertheless, is more like a crocodile or turtle in fundamental



COURTESY AMER. MUS. OF NATL. HISTORY
TUATARA (*Sphenodon punctatum*) OF
NEW ZEALAND

structure. It is about 2 ft. long and thick-set in form. The tuatara was formerly common on New Zealand but is now confined to a few small neighboring islands. It lives in burrows or cavities in close association with petrels and is nocturnal and largely

insectivorous in habit. The eggs are deposited in the ground and left covered with dead leaves and other débris.

TUBA, a brass wind-instrument providing the bass of the brass choir in the modern ORCHESTRA and forming a unit with the three trombones, two alto and one bass, which play above it. The name *tuba* is a somewhat general one, often referring to a brass instrument, much used in the military band, called the euphonium, but the orchestral tuba in F is generally understood as the instrument intended; varieties of it are the *bombardon* and *helicon*. Largely owing to the influence of RICHARD WAGNER (1813-83) it acquired a permanent seat in the full orchestra where its enormous power and profound register make it exceedingly valuable when used with discretion. In general construction it resembles the HORN on a gigantic scale. The orchestral tuba in F has a compass of three octaves, from F_1 to f' (see OCTAVE for an explanation of this terminology). The usual compass of the bass tuba is from F_2 to e' flat, and of the euphonium from D_1 flat to b' flat. The evolution of the tuba may be traced to the serpent trumpet which was popular during the 18th century, and to the *ophicleide* which was popular during the 19th century. Both of these have been superseded, either by one form or another of the tuba, or by a family of brass wind instruments, varying in compass, called the SAXHORN.

TUBATULABAL, a small tribe of North American Indians belonging to the Shoshonean linguistic stock. They formerly occupied the valley of the Kern river, particularly the junction of the main and south forks in southern California. Though surrounded by typical Plateau Shoshoneans their speech has much in common with the Shoshonean idioms of southern California. Baskets and pottery and other items of material culture are scarcely distinguishable from the YOKUTS. Their social customs, however, are highly distinctive. In 1770 they numbered 1,000.

TUBERCULOSIS, an acute or chronic disease which can attack any organ of the body. The organ most commonly attacked is the lung and such disease is known as pulmonary tuberculosis, phthisis or consumption.

The antiquity of the disease can be traced back to the New-Stone Age, some 10,000 years ago, before civilization started. Such evidence is obtained through tuberculous bones which have been discovered. Tuberculosis of the spine (Pott's Disease) has been noted in Egyptian mummies dating 1500 B.C. Infection with tuberculosis is almost universal in civilized races, but fortunately only a small percentage develop active disease, as the resistance of such races is greatly enhanced by generations of conflict with the disease.

The bacillus of tuberculosis was discovered by Koch in 1882. There are three types: the "human" which causes the majority of deaths; the "bovine" which is the disease of cattle and can be transmitted to children through unpasteurized milk, and the "avian" which causes serious losses in poultry and hogs, but rarely

attacks man. The human bacillus is airborne and usually infects the lungs.

The majority of young people, especially in cities, become infected before leaving high school. The childhood infection, known as "first infection," generally does not disturb health. Some children may become irritable, anemic, stop gaining weight and have a little daily fever. In general, this "first infection" of childhood is believed to protect against reinfection, as in the majority fairly complete healing with calcification takes place. Calcified tubercles can be detected in the lungs on the X-ray films of such children. With others, tubercle bacilli may remain quiescent only to triumph with manifest disease in early adult life or in later years. Tuberculins, or extracts of dead tubercle bacilli, are used to test the presence of infection in children and in cattle.

Careful study of various communities has shown that 1% of the adult population have active pulmonary tuberculosis and another 1% have quiescent or arrested disease. Many people with active pulmonary tuberculosis may appear healthy, yet they may infect others, especially children, and may be considered CARRIERS OF DISEASE. There is a fairly high death rate in children up to four years from tuberculous meningitis and acute forms of the disease. The highest death rates in adults from pulmonary tuberculosis occur between the ages of 20 and 45; but from 50 to advanced years, the death rate is still considerable.

To a great degree tuberculosis is a family disease, but is not inherited. The opportunity for infection of children by a tuberculous parent or nurse can be readily understood, especially in tenements. Preventive measures aim at removing tuberculous patients to sanatoria, or removing children of such patients to preventoria and nutrition camps. In Europe a method of vaccinating infants against tuberculosis is being attempted on a large scale. A vaccine named B.C.G. (*Bacillus-Calmette-Guerin*) is administered to newborn babies, usually by mouth. Doubts have been raised as to the safety of this method, but the general results have indicated a lowering of the death rate from tuberculosis in children, though many years will be needed before its value in preventing adult tuberculosis is known. The pasteurization of milk has markedly decreased bovine infection in childhood. X-ray examinations of the chest in high school children would do much to detect cases of beginning pulmonary tuberculosis, when cure is more certain. Improvement in economic conditions and protection in dusty trades would help reduce tuberculosis mortality. (See also LIGHT, ARTIFICIAL, IN TREATMENT OF DISEASE.)

The diagnosis of pulmonary tuberculosis in adults is made by the careful taking of a patient's history, by X-ray, by examination with the stethoscope, with the patient's body bared, and by repeated examinations of the expectoration. When pleurisy, cough or pulmonary hemorrhage (blood-spitting of a teaspoonful or more) have occurred, then pulmonary tuberculosis is already advanced. X-ray chest examination

is essential. Such examinations should be made every year, especially from puberty on, of those in whose family there have been tuberculous members.

There are many conditions disturbing health which need careful investigation for possible tuberculosis. Continued hoarseness, rectal abscess, frequent or protracted colds, digestive disturbances, headaches, menstrual irregularities, weight loss, insomnia, pains in the chest, nervousness and sweats. Pulmonary tuberculosis of the adult type can occur in children. The possible complications of pulmonary tuberculosis are many. Not only may a patient with this disease develop any other disease, but the tubercle bacillus may also attack the eye, the ear, the intestines, the kidneys, the larynx, the testicles, the joints and bones, the lymph glands—in fact, any organ of the body. (See also LYMPHATIC SYSTEM, DISEASES OF.) Tuberculosis of the adrenal glands, known as ADDISON'S DISEASE, is probably the rarest form. Tuberculous meningitis, for which there is no remedy, may occasionally bring about a rapid termination of life in consumptives. At times tuberculosis of one or more organs may arise with absence of disease in the lungs. Prolonged and chronic cases of pulmonary tuberculosis may end fatally by degenerative disease of the heart or kidney.

Upon a diagnosis of tuberculosis, the patient should enter the nearest sanatorium and if possible stay there several years. The only cure is prolonged rest, as tuberculosis will relapse, even after all active signs and symptoms have disappeared. It is doubtful if any type of tuberculosis can be cured in less than four years. Rest is essential—rest of the lungs by staying in bed, by posture, by splinting (artificial PNEUMOTHORAX, phrenicectomy, thoracoplasty); rest of a tuberculous larynx by silence; rest of a tuberculous bone or joint by splints. There are no medicines that can cure tuberculosis, but remedies may be needed to relieve distressing symptoms. Patients must always place themselves under competent medical care and not listen to solicitous friends. The sanatorium régime, in any climate, offers the best results. Having something to do will aid in keeping up the morale and courage. That tuberculosis is a curable disease is indicated by the finding of healed spots in post-mortem examination of the bodies of a majority of persons dying of other diseases.

While the death rate from tuberculosis has declined from about 150 per hundred thousand living to about 85 per hundred thousand living in the last twenty years, the disease is still a serious problem. Much has been done for the suppression and control of tuberculosis in communities by The National Tuberculosis Association.

G. B. W.

TUBERCULOSIS, BOVINE, a form of tuberculosis which is affecting cattle the world over. In spite of the efforts of state and Federal authorities it is prevalent in many parts of the United States. Tuberculosis, caused by *Bacillus tuberculosis*, may be transmitted to man through infected milk or meat. In cattle, the organs chiefly affected are the lungs, liver, intestines and lymphatic system, the tubercles generally

being found attached to the membranes lining the chest and abdomen.

The symptoms include fever, difficult breathing, debility, cough, diarrhoea, enlarged throat glands and, in cows, loss of milk. Often animals show no constitutional alterations and the disease can be diagnosed only by a tuberculin test. Many farmers have objected to this test, mistakenly thinking that the injection of tuberculin infected the animal with the disease, and in some sections of the country riots have occurred when authorities attempted to test suspected cattle. Tuberculin is a sterilized culture of bacilli and while it causes a rise in temperature in infected cattle it does not affect healthy animals. Tuberculous cattle should be destroyed at once to prevent the infection of the remaining herd. There is no known cure for the disease.

TUBERCULOUS MENINGITIS. See MENINGITIS.

TUBEROSE (*Polianthes tuberosa*), a perennial herbaceous plant of the amaryllis family, widely cultivated for its sweet-scented flowers. It is believed to be originally a native of Mexico although the form now grown is not known in the wild state. The plant, which rises from a bulblike tuber, whence its name, grows usually 2 to 3 ft. high, with an erect unbranched stem bearing very narrow, grass-like leaves, and large, waxy-white, somewhat lily-like, exceedingly fragrant flowers arranged in pairs in a narrow terminal cluster.

TUBES, ELECTRONIC, glass tubes partially or thoroughly evacuated and containing a piece of metal which can be electrically heated so that electrons are emitted. The electron emitter, called a CATHODE, may be a simple filament, as in any type of wire-filament electric lamp, or it may be a sleeve of conducting material indirectly heated by a hot filament. In the simplest form of electronic tube, a cold conducting plate forms the second ELECTRODE. The device may be used for rectifying ALTERNATING CURRENT since electrons are available to go from cathode to plate; but, unless the potentials are high, practically no electrons are freed at the plate to return to the cathode.

The well known three-element electronic tube consists of a cathode and plate with an open network of wire inserted between them. This third element is called a grid. At the expense of relatively little power, changes in potential between grid and filament may be used to control relatively great power in the plate circuit of the tube. The tube then operates as an amplifying relay. It may also be used as an amplifying DETECTOR in a radio circuit.

The addition of a second grid between the control grid described and the plate provides an electrostatic shield between these two elements. This tube is called a tetrode. See also PENTODE, SCREEN GRID TUBE.

L. G. H.

Theory. An incandescent filament in a vacuum tube emits ELECTRONS which are attracted to the positive plate causing a flow through the vacuum. When

many electrons are emitted per second, a cloud of negative electricity, or "space charge," forms between the filament and plate and opposes further emissions from the filament. A third electrode or grid inserted between the filament and plate increases the space charge effect if negative and decreases it if positive. If a small alternating voltage is applied to the grid, the space charge effect varies with the grid voltage and the electron current flowing to the plate is a counterpart of the grid voltage. At the same time, the original grid voltage is amplified from six to thirty times, depending on the tube used. The three-electrode tube, or triode, is essentially an amplifier; triodes connected in series give amplification of tens of thousands of times.

The triode can be adjusted so that the increase in plate current for a given increase in grid voltage exceeds the corresponding decrease in plate current for an equal decrease in grid voltage. When an alternating voltage is applied to the grid its amplified counterpart appears in the plate as a rectified current capable of actuating telephones in series with the plate. The tube is used in this manner to detect high frequency or radio waves.

Because of its amplifying characteristics, the triode is a generator of sustained oscillations. Any electrical disturbance in the tube circuit sets up weak oscillations in an oscillatory system. This oscillation is amplified by the tube and part of the energy of the magnified oscillation in the plate is returned to the grid to strengthen the oscillations there. Energy drawn from the filament and plate batteries maintains the action continuously.

R. T. C.; W. A. L.

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TUCANA (gen. *Tucanae*), the toucan, a southern constellation composed chiefly of stars of the fourth magnitude. In addition to the interesting quadrangle star Beta Tucanae, it contains the small MAGELLANIC CLOUD. See STAR: map.

TUCKAHOE, a village in Westchester Co., southeastern New York, a residential suburb of New York City, situated about 18 mi. northeast of Manhattan. It is served by the New York Central Railroad. The village has lime and marble dust works, marble quarries and a drug factory. Truck crops are raised in the vicinity. Pop. 1920, 3,509; 1930, 6,138.

TUCSON, a city in southeastern Arizona, in Pima Co., situated on the Santa Cruz River and served by the Southern Pacific Railroad which connects from Tucson with the Southern Pacific of Mexico Railroad. Tucson has air mail and passenger service, and is on a direct route to Mexico. Cotton is the chief crop in the vicinity. The city has railroad shops and is a tourist resort. In 1929 the industrial output reached an approximate total of \$4,000,000; the retail trade amounted to \$23,567,558. Poultry breeding and dairying are the leading interests of the vicinity. It is the seat of the University of Arizona. Tucson was an Indian settlement when Coronado visited here in 1540.

The remains of the Pueblo village are nearby. The beautiful Spanish missions dating from 1687 give the city a rare charm. Tucson was incorporated in 1883. Pop. 1920, 20,292; 1930, 32,506.

TUCUMAN, a city of northern Argentina, situated on the Soli River about 780 mi. northwest of Buenos Aires. It is a typical Spanish town, with low, thick-walled houses built around inner courts. Sugar-cane is the chief product of the district. The climate is hot, and summer temperatures have gone well over 100°. Est. pop. 1930, 116,219.

TUCUMCARI, a town in northeastern New Mexico, the county seat of Quay Co. It is situated 120 mi. west of Amarillo, Tex., and is served by three railroads. Coal is found in the vicinity, and the town is a shipping point for coal, coke, wheat and cattle. Pop. 1920, 3,117; 1930, 4,143.

TUDOR, HOUSE OF, a family of Welsh descent, five members of which occupied the English throne. Ednyfed Vychen of Tregarnedd in Anglesey, founder of the house, was steward of Llywelyn, prince of North Wales, in 1232. His sons held official positions under Richard II. Owen ap Meredydd, or Owen Tudor, his grandson, contracted an alliance with the mother of Henry VI, his eldest son being subsequently legitimized. Henry VII, grandson of Owen, succeeded to the throne on the death of Richard III. His son, Henry VIII (1491-1547) brought about the separation of the Church of England from the Church of Rome. The later Tudor sovereigns were Edward VI, Mary and Elizabeth, whose reign was the golden age of England in exploration, commerce and literature.

TUDOR STYLE, the term applied to English Gothic architecture in its final period. It may be roughly dated as beginning with the end of the Wars of the Roses in 1485, and continuing until the beginning of the reign of Elizabeth, in 1558. Tudor Gothic was the last development of the PERPENDICULAR STYLE, and some authorities use the words synonymously. More strictly speaking, however, Tudor marks the transition between Perpendicular Gothic and Elizabethan. (See ELIZABETHAN STYLE.) Its use was ecclesiastical, collegiate and domestic. In church building, the Tudor style shows the characteristic of extreme Perpendicular, as in its vertical and horizontal lines, its lavish ornamentation, its elaboration of fan vaulting (see FAN VAULT) beyond structural significance, and its use of the flattened Tudor arch. In secular work, the Tudor style shows us a marked development of the English manor house, marked by the use of half-timber and brickwork, the addition of oriel windows, the prevalence of gabled roofs and considerable variety in treatment. The word is also applied to the interior detail and decoration of the time, in which wood paneling was a noticeable feature. For bibliography see GOTHIC ARCHITECTURE; RENAISSANCE ARCHITECTURE.

TUFA, called also calcareous tufa, calcareous sinter and TRAVERTINE, is a form of LIMESTONE deposited from springs, or underground waters. Slow deposi-

tion from cold waters in the caverns of limestone regions produces STALACTITES and STALAGMITES, and cave ONYX or marble onyx. More rapid precipitation from hot springs results in loose coatings on bits of vegetation, or earthy material, forming somewhat porous or cellular, but firm masses. This latter is travertine, used in building. The best deposits of tufa are found in regions of abundant hot springs, where great natural terraces of it are often striking features. Yellowstone Park, California, Mexico, Italy and New Zealand possess such areas of thermal activity. *See also* PETROLOGY; DEPOSITS.

TUFF, a term covering a wide variety of fragmental rocks composed of finely divided material ejected from VOLCANOES. This material, mostly VOLCANIC ASH, dust, sand and lapilli, accumulates in beds after transportation by wind or water. These beds are in many instances interbedded with LAVA flows of the same lithological character, and are found associated with volcanic rocks of all ages and localities. *See also* PETROLOGY; DEPOSITS; AGGLOMERATE.

TUFTS COLLEGE, at Medford, Mass., in part a coeducational institution, was founded in 1852. It owed its beginning to the efforts and support of members of the Universalist denomination, but is non-sectarian. Women were admitted with men in 1892, and in 1910, Jackson College for Women was opened as an affiliated institution for women students. With the exception of the dean, the faculty is the same for both colleges. Tufts College had an endowment in 1931 of \$8,503,896. Eaton Memorial Library has 100,647 volumes including the special collection of 6,000 volumes of the Universalist Historical Society. In 1931-32 there were 1,966 students, and a faculty of 470, headed by Pres. JOHN ALBERT COUSENS.

TU FU (713-770), Chinese poet and painter of the T'ang dynasty, was born in Tu Ling, Shensi Province, in 713. Failing of political preferment because of the heterodoxy of his views, he led the life of a wanderer. His quaint lyrics are ranked with those of his friend, Li Po. Tu Fu died at Hu Huang in 770.

TUGBOATS. *See* BOAT.

TUG OF WAR, a sport in which each of two groups pulling upon opposite ends of the same rope attempts to pull the opposing party beyond an agreed point. At times the center of the rope is marked and the party which moves this marker an agreed number of feet in its direction is the winner. Frequently, particularly in American colleges, the opposing parties are placed upon the opposite sides of a shallow river, pond or even mud hole; in which case the winner drags the other party through the water or mud. There is no limit upon the number of players, and the only generally accepted technique is to place the heavier players farther from the center of the rope with the heaviest as anchor man at the end. In the early days of American railroading tugs of war between locomotives of different design or produced by rival shops were frequently held to try out their relative tractive power.

TUILERIES, LES. 1. A popular public garden in Paris, laid out over an area of about 60 acres by the landscape architect Le Nôtre, under Louis XIV. Beautified with fountains and sculptures it is a favorite promenade and extends from the site of the Tuileries Palace to the Place de la Concorde, bounded on one side by the Quai des Tuileries and on the other by the Rue de Rivoli. 2. The Palace of the Tuileries was begun about 1565 by Catherine de' Medici who employed Philibert Delorme as architect. Succeeding monarchs, notably Henri IV, who built the Pavillon de Flore, and Louis XIV, builder of the Pavillon de Marsan, made additions to the structure but never completed it. Used chiefly for great *fêtes*, it became the residence of Napoleon. Except for the Pavillon de Flore, it was destroyed by the Commune in 1871.

TUKKUTCHKUTCHIN, a sub-tribe of the Kutchin, an American Indian group belonging to the northern division of the Athapaskan linguistic stock. They occupy the district between the headwaters of the Porcupine River and Fort McPherson in Yukon Territory, Canada. Like many of the other northern Athapaskan tribes they are trading intermediaries between the interior and coast tribes. They are good hunters, living almost entirely on the caribou and its products.

TULA, administrative center of Tula district in the Moscow Region of the R.S.F.S.R., 120 mi. south of Moscow, at the confluence of the Upa and Tulitsa rivers. Half of the adult inhabitants engage in metal-working. Many plants which have produced rifles and military implements since 1595 are now manufacturing cutlery, samovars and other metal objects. The State arms factory, founded in 1712, still exists. These enterprises have been determined by the proximity of rich iron and coal mines. In the late 10th century Ryazan princes built a fortress here; Lithuanians and Tatars later overran the territory. Revolutionary upheavals in the 17th century and the establishment of smelting works and iron foundries by foreign capitalists occurred almost simultaneously. There is a very large sugar refinery. Tula's Art and History Museum is notable, and the 16th century Kremlin is well preserved. Pop. 1926, 147,817.

TULANE UNIVERSITY OF LOUISIANA, a non-sectarian, coeducational institution at New Orleans, La. It was established in 1849 as the University of Louisiana, with the Medical College of Louisiana, founded in 1834, becoming a part of the university. In 1884, the university was transferred to the control of the Board of Administration of the Tulane University fund, founded by Paul Tulane in 1882, and the present title was adopted. Productive funds of the university in 1931 amounted to \$8,982,001. The library contains 130,668 volumes. In 1930-31 there were 4,556 students, and a faculty of 441, headed by Pres. ALBERT B. DINWIDDIE.

TULARE, a city in Tulare Co., southern California, 45 mi. southeast of Fresno, served by buses and the Southern Pacific and Santa Fe railroads. The city

is a trade center for a region producing cotton, peaches, prunes, grapes, poultry and dairy products. It has cotton gins and creameries. Tulare was founded and incorporated in 1880. It is 35 mi. southwest of Sequoia National Park, noted for its big trees. Pop. 1920, 3,539; 1930, 6,207.

TULAREMIA, primarily a disease of wild rodents, especially of wild rabbits and hares, due to *Bacterium tularensis*; secondarily a disease of man, contracted principally by dressing infected wild rabbits or by the bite of a blood-sucking fly or tick which has previously fed on an infected rabbit. Tularemia was discovered by McCoy of the United States Public Health Service in 1910 in the ground squirrels of Tulare County, California, hence the name.

About 2,500 human cases have thus far occurred in the United States (1931). The disease has become recognized in Japan (1925), Russia (1928), Norway (1929), and Canada (1930), and Sweden (1931), but not in any other country.

Rabbits sicken and die in from five to seven days after inoculation, manifesting innumerable small white round spots, ranging in size from pin point to pin head distributed over the spleen and liver. But if an infected rabbit is shot on the third day, before the spots have developed to visible size, the inspection of liver and spleen fails to detect the dangerous infected condition of the rabbit. About 1% of wild rabbits are infected in the United States. Domesticated rabbits raised in rabbitries and sold for food have not been found infected in nature although they are highly susceptible to experimental inoculation in the laboratory.

Cooks, hunters and market men who dress infected rabbits with bare hands readily inoculate themselves through a cut or scratch, the infection passing from the rabbit tissues to the hand, resulting in an ulcer on the hand, enlarged lymph glands at the elbow and in the armpit and fever which confines the patient to bed for two or three weeks.

Penetration of the uninjured skin of the hand by the virus is also believed to occur, because in laboratory workers who contract the disease there is no ulcer on the hands and no enlarged lymph glands. Rabbits and guinea-pigs can also be infected by gently placing a culture on the normal uninjured skin of the animal.

Fingers which have crushed infected ticks or flies or which have remained unwashed after dressing infected animals may transfer the infection to the eyes, causing conjunctivitis. Fly-bite is usually on the exposed parts of the head, neck or face, while tick-bite is usually under the clothing or in the hair.

Communication of the disease from person to person does not occur. Man, however, is highly susceptible to the infection as it exists in animals, ticks and flies.

The diagnosis is made by a laboratory test as in typhoid fever.

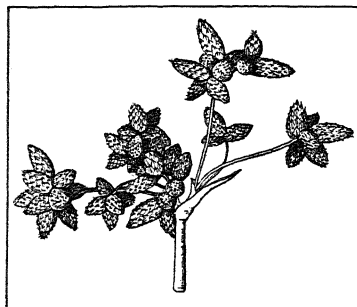
Weakness and loss of weight are prominent symptoms in man. A skin eruption or subcutaneous nodules develop in about 1% of cases. Pneumonia is

a serious and rather frequent complication in the second week of illness. Convalescence is slow. One attack in man is followed by a lasting immunity. Death occurs in about 5.3% of cases. No preventive vaccine or curative serum has been perfected nor has any special drug been found effective. Rest in bed is most important.

Prevention is the keynote of modern medicine. Rubber gloves afford complete protection to those who must dress wild rabbits, squirrels or quail, or who skin muskrat, opossum, skunk, woodchuck, coyote or rat. Market inspection of rabbits is impracticable. However, rabbit meat, thoroughly cooked, is harmless as food, because a temperature of 133°F. kills the infection. None of the meat should remain red, nor should any red juice remain about the bone. Avoid a rabbit found dead, or one easily killed. The disease is new, but the warning is 5,000 years old; read Leviticus XI: "The flesh of the hare shall ye not eat, and its carcass shall ye not touch; they are unclean to you."

E. F.

TULE, the name given in the Pacific states to a species of bulrush (*Scirpus acutus*), very abundant in salt and fresh water marshes. The green, usually leafless stems, 3 to 9 ft. high, rising from stout creeping



FROM JEPSON, M. N. FL. PLANTS CALIF.. COPYRIGHT

TULE

rootstocks, bear at the summit numerous flowering spikelets crowded in irregular clusters. W. L. Jepson estimates that there were originally in California about 250,000 acres of tule lands; much of this area has been reclaimed for cultivation through drainage. Tule stems are used for thatching and packing material and to a limited extent as a source of potash.

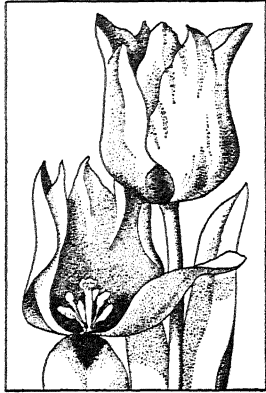
TULE POTATO, a name given in California to the broad-leaved ARROWHEAD, an aquatic plant producing starchy tubers eaten by the Indians and also by the Chinese, who often cultivate it.

TULIP (*Tulipa*), a large Old World genus of bulbous plants of the lily family, natives of the Mediterranean region of Europe, North Africa, Turkey, Asia Minor, Russia, Siberia, China and Japan. Of the usually recognized 50 or more species only a few are in general cultivation for their showy bell-shaped or funnel-formed flowers, but these have given rise to thousands of varieties.

Because of their ease of culture, hardiness, brilliance, wide range of form and color, adaptability to formal plantings, long blooming period and low cost they

have been for centuries the most popular of all spring flowering bulbs. They are also valued for growing in greenhouses because they are easily forced.

Though some pure species are grown in botanical gardens and by fanciers, interest centers mainly in cultivated varieties. These are grouped into early single and double, low growing, proportionately large-flowered kinds used mainly for formal bedding and forcing; cottage or May-flowering, main-season, taller varieties, which follow the latest of the early varieties; and Darwins, which succeed the cottage group, notable for their height, large size of blossom and the richness of their colors—crimsons, reds and purples, but no yellows. Minor groups are bybloems,



TULIP
Tulipa Eichleri

white varieties with lilac or purple markings; bizzarres, yellows with brown or red over-colors; parrots or dragons, weak-stemmed, curiously colored and marked flowers with frayed-edged petals; and breeders, rivals of the Darwins in height, size of bloom and richness of coloring, but distinguished by the bronzy or coppery sheen of their petals. Another group is called "lily-flowered" because of the form of its blossoms.

Breaking is the unique characteristic of all tulips grown from seed. The flowers at first are "selves" (each of a single color) but the same bulbs later tend to produce different colors. The self stage is therefore called a breeding period. When tulip bulbs are propagated from bulbs instead of seeds they reproduce the same stage of development as the parent bulbs.

Tulips thrive in any garden soil but do best in rich, sandy loam. The bulbs are planted four inches deep in October or November, the ground kept bare until winter sets in and then heavily mulched with litter or marsh hay. If this is applied before the ground freezes mice may nest in it and destroy the bulbs. When spring begins the mulch must be removed. After the plants have bloomed, the foliage must be allowed to turn brown so the bulbs may store up food for the following year. They may then be dug, dried, cleaned and stored until autumn or be left in the ground from year to year.

Speculation in tulips during the first half of the 17th century gave origin to the term tulipomania.

More bulbs than existed were sold; ownership was divided into shares; many bulbs were sold before their origination; and individual bulbs brought as high as \$5,200. M. G. K.

TULIP TREE (*Liriodendron Tulipifera*), a handsome forest tree of the magnolia family, called also yellow poplar and whitewood. It is native to moist rich soils from southern New England to northern Illinois and southward to Florida and is widely planted for ornament in the eastern states and in Europe. The tree, one of the largest found in eastern North America, attains its greatest size and abundance in the lower Ohio Valley and on the basal slopes of the Alleghenies in North Carolina and Tennessee where it sometimes grows 150 to 190 ft. high, with a straight trunk 4 to 10 ft. in diameter. The slender branchlets bear large, shining, four-lobed leaves, which turn clear yellow in autumn, and tulip-like, yellowish-orange flowers, 2 in. long, followed by a dry cone-like fruit.

Under the name yellow poplar the tulip tree is extensively manufactured into lumber highly valued for cabinet work, furniture, woodenware and interior finish. According to the Fifteenth Census the total cut in the United States in 1930 of yellow poplar lumber amounted to 257,803,000 bd. ft., valued at the mill at \$9,072,087.

TULSA, a city in northeastern Oklahoma, the county seat of Tulsa Co. It is situated on the Arkansas River, 121 mi. northeast of Oklahoma City. Transcontinental airlines, bus and truck lines and four railroads serve the city. Tulsa has been called the "Oil Capital of the World," and is the headquarters of numerous oil companies operating in the mid-continent. The principal manufactures are refined petroleum products, oil field equipment and supplies, cotton mill products, furniture, glassware, chemicals, paints and clay products. In 1929 the total factory output was worth about \$26,000,000. The wholesale trade proper in 1929 amounted to \$50,422,414 and the retail to \$93,334,316. The International Petroleum Exposition is held here every year. It is the seat of the University of Tulsa. "Tulsey Town," as it was called, was founded in 1882, and the city was chartered in 1902. The vicinity became important as an oil producing center in 1901, but Tulsa's greatest period of growth has been since 1920. Pop. 1920, 72,075; 1930, 141,258.

TULSA, UNIVERSITY OF, at Tulsa, Okla., a coeducational, privately controlled, interdenominational university, opened in 1894. To the departments of Arts and Science, Music and Law, it added a summer school in 1927. The productive funds in 1931 amounted to \$735,790. There were 24,053 volumes in the library. In 1931-32 there were 898 students, and a faculty of 62, headed by Chancellor JOHN D. FINLAYSON.

TUMACACORI, a national monument containing an old Spanish mission ruin, is situated in Santa Cruz Co., southern Arizona. It was created Sept. 15, 1908 and is 10 acres in area. According to the



TULIPS (*Tulipa Clusiana*)

most authentic information available, the Mission San Jose de Tumacacori was founded in 1691 by the Jesuit priest, missionary and explorer, Father Eusebio Francisco Kino. From 1769 until the early 19th century it was maintained by priests of the order of Franciscan Fathers. The ruins consist of the walls and tower of an old church building, the walls of a mortuary chamber and a court or churchyard surrounded by an adobe wall $2\frac{1}{2}$ ft. thick and 6 ft. high. The adobe walls of the church proper are 6 ft. thick, with an inch thick coating of lime mortar. The inside dimensions of the church are 18 by 75 ft. The space used for the altar is 18 ft. square and is surmounted with a circular dome. The walls are partly decorated with colored frescoes. Restoration work is being carried on by the superintendent of Southwestern National Monuments. The mission is on a U.S. Highway. It is 49 mi. south of Tucson on the main line of the Southern Pacific Railroad and the Bankhead and Old Spanish Trail highways and is 19 mi. north of Nogales.

TUMBLEWEED, the name given in the prairie regions of the northwest to various annuals the seeds of which are widely disseminated by the wind. When mature the much branched stems are readily uprooted or broken off by strong autumn gales which roll or tumble them to great distances scattering their seeds from field to field. Among the most common tumbleweeds are the winged pigweed (*Cycloloma atriplicifolium*), the bugseed (*Corispermum hyssopifolium*), the tumbling pigweed (*Amaranthus gracizans*), the Russian thistle (*Salsola Kali* var. *tenuifolia*) and the tumbling mustard (*Sisymbrium altissimum*).



COURTESY U.S. DEPT. OF AGRIC.

TUMBLING MUSTARD

Lower stem and root, pinnatifid leaf, flowering pannicle and a single flower

TUMBLING, a series of athletic exercises usually practiced on a mat in a gymnasium, and divided into individual exercises and those in which two or three performers participate. Walking on the hands, cart

wheels, forward and backward somersaults, and combinations of these are some of the exercises used. See **ACROBATICS**.

See Spalding Athletic Handbooks, *Tumbling for Amateurs*.

TUMBLING MUSTARD (*Sisymbrium altissimum*), a smooth herb of the mustard family native to Europe and widely naturalized in North America. It is an erect, freely branching plant, 2 to 4 ft. high, with large, deeply cut lower leaves and small, narrow upper leaves, whitish-yellow flowers and very slender, stiff, widely diverging pods containing numerous small seeds. In grain fields of the Northwest it has become a pernicious weed.

TUMORS, circumscribed swellings produced by an abnormal growth of new tissue. The term is not used to denote generalized swellings due to inflammation.

Tumors are of many varieties and may occur in almost any part of the body, differing in either form or structure from the normal tissues in which they are found. Microscopically some are seen to be composed of normal body tissues, arranged in an abnormal manner. In the type of tumor known as a dermoid cyst, there may be found bits of bone, teeth and hair. Other tumors contain tissue unlike any of the normal tissues of the human body.

The causes for tumor formation are not definitely known. The theory that apparently receives the greatest support is that the tumors start in cells which, in the embryo, for some undetermined reason, have failed to develop normally. Later on in adult life, these cells undergo a delayed and abnormal development.

Tumors are divided into two groups according to their affect upon health and life: benign and malignant.

The *benign tumors* resemble closely the surrounding normal tissues and are relatively harmless, except that they may exert mechanical pressure upon surrounding organs. Fatty and fibrous tumors are probably the most common types. A large fatty tumor on the scalp may be only a blemish, but a large benign tumor in the brain or within the chest may cause serious symptoms because of pressure on surrounding structures.

Malignant tumors differ radically from the normal structures and not only grow at the point where they originate, but tumor cells are carried to other parts of the body where they grow and develop. The tumor forms finger-like extensions into the normal tissues, and cells are carried through the lymph channels into lymph glands. Malignant tumors, as a rule, grow faster than benign ones. In their advanced stages they produce wasting and weakness.

If benign tumors are accessible, they can be thoroughly removed and will not recur. It is difficult, and in many instances impossible, to remove malignant tumors thoroughly except in the very early stages of their growth. If complete removal is not effected, growth of the remaining cells continues, with fatal termination.

CANCER, or carcinoma, is the most frequent of the malignant tumors. Cancers originate in the skin or in the lining membranes of various internal organs or ducts. They extend particularly through the lymph channels. Sarcoma, the second class of malignant tumors, does not start on mucous membranes, but in the deeper parts of the tissues. The cells are disseminated to a greater extent by the blood.

The most common sites for cancer are the lips, tongue, gums and cheeks (*see* MOUTH, DISEASES OF), larynx and esophagus, stomach, large intestine, womb and breasts. Some of the most frequent sites for sarcoma are the kidneys, bones, and the pigmented coat of the eyeball. (*See also* BLADDER, URINARY; UROLOGY.)

Probably the most important tumors of the benign group are the fibroid tumors of the womb. They are likely to produce bleeding and interfere with the normal course of pregnancy.

The ovaries are often the site of cystic tumors composed of enclosed sacs of clear, watery fluid. For tumors of the brain and spinal cord, *see* NEUROSURGERY.

W. I. F.

TUNA, the Spanish name for the TUNNY or horse mackerel (*Thunnus thynnus*), now applied in the United States, especially on the Pacific coast, to various tunny-like fishes of the mackerel family, as the leaping tuna (*Thunnus saliens*), a very large game fish, and to several much smaller food fishes, as the albacore, bluefin, bonito, skipjack or striped tuna and yellowfin. In 1929 the total commercial catch of tuna and tuna-like fishes in the United States waters of the Pacific coast was 85,123,000 lbs., valued at \$3,909,000. Of this amount yellowfin comprised 37,399,000 lbs., with a value of \$2,200,000, and skipjack, 26,998,000 lbs. valued at \$1,081,000. A large part of this catch is manufactured into canned tuna. In 1929 this product amounted to 1,504,306 cases with a value of \$9,873,453.

TUNA FISHING, a sport which its devotees claim is unrivaled. The tuna, found in all warm seas, is a food fish of great commercial importance in the Mediterranean. It inhabits the Atlantic as far north as Newfoundland and the Pacific Ocean off California, north to Monterey Bay. The tuna is the largest of the mackerel family, and there is a record of a tuna 10½ feet long, weighing 758 pounds, caught off Nova Scotia. In California waters, the fish are not as large, and the record there for a fish caught with hook and line is 251 pounds. The Tuna Club awards its blue button to fishermen catching tuna weighing over 100 pounds, and on an average of a dozen buttons are awarded each year.

A pole of green heart or split bamboo from 7 to 8½ feet long is best. The cork grip above the reel should have a brake and click. About 700 feet of 21-strand line are used, equipped with a piano wire leader 5 or 6 feet long. A No. 9-0 O'Shaughnessy hook is baited with a flying fish of about 3 pounds. While playing a fish, the butt of the rod is fitted into a leather cup beside the seat or slung from the fisherman's belt. A fight may last from 15 minutes to 15

hours. One fish of 125 pounds towed a boat 20 miles in five hours. The tuna has been called "the tiger of the sea" and "the king of all game fish—a living meteor which strikes like a whirlwind."

See Zane Grey, *Tales of Swordfish and Tuna*, 1927.

TUNBRIDGE WELLS, an inland watering-place of Kent, England, beautifully situated in picturesque surroundings, 32 mi. southeast of London. It owes its rise to the discovery of chalybeate springs in the vicinity by Dudley, Lord North in 1606, and its popularity to the patronage of English royalty. The famed Pantiles, a raised parade lined by shops, a colonnade and by a graceful avenue of lines, recalls the days of fashion and Queen Anne, Beau Nash and Dr. Johnson. To-day the manufacture of toys and other articles in various, inlaid hardwoods, known as Tunbridge Ware, is a staple local industry. Pop. 1931, 36,000.

TUNDRA, the Russian name for cold wastes bordering the arctic shores of Russia, Siberia, Alaska, and Canada. These treeless plains represent the northernmost plant associations in the world.

The subsoil of the Siberian tundra is perpetually frozen to great depths in which the carcasses of woolly mammoths and other extinct animals have been found preserved intact. During the brief hot weeks of summer the surface thaws for a few inches, forming a vast quaking bog, or tundra-moor. It is then spangled with flowers and carpeted with white reindeer-moss and other lichens, peat-mosses, and low berry-bushes, which attract small fur-bearing animals and migratory birds. Wild reindeer roam the tundra, also reindeer-breeding nomads, who migrate with their herds. Tree-growth, often stunted to knee-height on the edge of the tundra, gradually increases in size to the southward to the borders of the forest region known as the taiga.

TUNED CIRCUIT, an electrical circuit in which, for a given FREQUENCY, the REACTANCE due to the INDUCTANCE is just balanced by that due to the CAPACITY. The circuit is said to be resonant at this frequency. *See also* RESONANCE, ELECTRICAL.

TUNED RADIO FREQUENCY RECEIVER. *See* RADIO FREQUENCY RECEIVER, TUNED.

TUNG, a medium-sized tree (*Aleurites Fordii*) of the spurge family important as the source of TUNG OIL obtained from its seeds. It is a native of eastern Asia, grown extensively in China and hardy in central Florida where its cultivation is of increasing importance. The tree grows usually from 25 to 40 ft. high with heart-shaped, deciduous leaves, numerous white, pink-centered flowers in loose terminal clusters appearing before the leaves and a globular drupe-like fruit, 2 to 3 in. in diameter, containing 2 to 5 rough, thick-shelled poisonous seeds. Tung trees are commonly grown on dry, thin soil, propagated either by seedlings or by cuttings. They begin to yield nuts in 3 to 6 years, an average tree producing annually 20 to 50 lbs. of nuts which contain about 25% of oil.

TUNGAR. *See* RECTIFIER.

TUNG OIL, an oil expressed from the kernels of the China wood-oil tree (*Aleurites Fordii*), called also tung-oil tree, native to eastern Asia and now cultivated in Florida. Tung oil is one of the heaviest known, weighing nearly 8 lbs. to the gallon. When heated to about 480° F. for a few minutes the oil changes to a gum that is insoluble in any known solvents. This property gives the oil great value, for in practical use it is heated almost to the changing point when a retardant is added. Then when the oil is mixed into paints or varnishes the change takes place after it is brushed on, forming a very smooth film, highly resistant to oils, water, heat or cold. Tung oil is utilized in numerous ways, as in the insulation of electric wires, and in making waterproof varnishes, deck paints, and oil cloth. In 1930 the imports of tung oil into the United States, comprising most of the export production of China, amounted to 126,323,000 lbs., valued at \$12,487,000. See also ALEURITES; CANDLENUT; WOOD-OIL TREE. B. F. W.

TUNGSTEN, or **WOLFRAM**, a metallic element (symbol W) discovered by Scheele in 1781. It is found in nature principally as minerals wolframite, $(\text{Mn}, \text{Fe})\text{WO}_4$, and scheelite, CaWO_4 , on all conti-

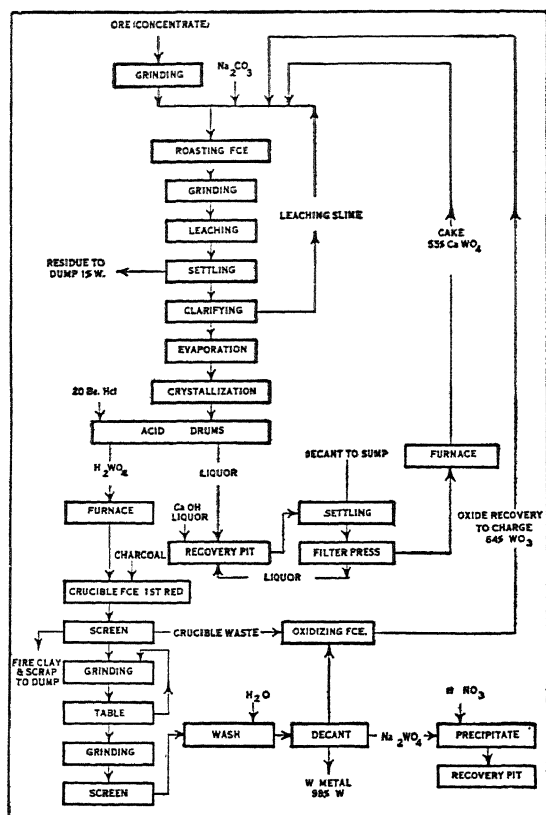
ducer. Most of the concentrates are converted in electric furnaces into ferrotungsten used in alloy steel (see IRON AND ITS ALLOYS). High speed steel contains about 18% tungsten; certain other steel contain from a fraction up to 10 per cent.

Tungsten metal is reduced at a red heat from its oxide WO_3 by hydrogen or carbon. When the powder is fine grained, it is black and when coarse grained, it is gray. The powder is pressed into briquets which are heated to about 3000° C. to produce coherent bodies. These are brittle cold but somewhat malleable hot. Mechanical working while hot ultimately changes the granular to a fibrous structure which results in increased strength and eventually cold ductility. In its coherent state tungsten is very resistant to oxidation in the air at ordinary temperatures. It is rapidly dissolved by fused alkali nitrates and nitrites and slowly attacked by strong aqua-regia or strong hydrogen peroxide. It is scarcely attacked by hydrochloric, nitric or sulphuric acids. It is readily dissolved by a mixture of hydrofluoric and nitric acids. When heated above a red heat in air it oxidizes rapidly and at a white heat the oxide vaporizes affording not even temporary protection against further oxidation. Tungsten and carbon form two carbides, WC and W_2C , the former being the hardest known metallic substance.

Although tungsten is a minor metal from the standpoint of the quantity produced, it is of major industrial importance. Its use as incandescent electric lamp filaments represents a saving to the world of about five billion dollars per year as compared with the cost of obtaining the same levels of illumination with carbon filament lamps. The savings effected by the use of high speed steel cannot be estimated. Additional savings are now in process as a result of the use of cemented tungsten carbide for cutting tools and dies. This material is made by mixing 85 to 98% tungsten carbide powder with a binder such as cobalt and pressing and sintering below complete fusion.

Pure tungsten is also used for contact points in automotive ignition systems; filaments and targets in X-ray tubes; filaments, heaters and supports in radio tubes; tungar rectifiers; electric furnace resistors; kene-trons; pliotrons; sun lamps, glass seals; and thyra-trons. Its atomic weight is 184, atomic number 74, melting point 3380° C., boiling point 5800° C., coefficient of linear expansion .0000444 per degree C. at 27° C., Young's modulus of elasticity 60,000,000 lbs. per sq. in. non-magnetic, tensile strength in fine drawn wire up to 650,000 lbs. per sq. in., one of the strongest known materials. Z. J.

TUNGUS, a group of languages of the TURCO-MONGOL-TUNGUS linguistic family spoken by a million individuals in a zone stretching east of the Yenisei to the sea of Okhotsk, in Manchuria, and in a colony near Kulja (Chinese Turkestan). The most important of the group is Manchu, the official language of China under the Manchu dynasty, 1644-1912, but now gradually dying out, the other dialects being spoken by the poor and mostly nomadic



COURTESY VANADIUM CORP. OF AMERICA

FLOW SHEET OF TUNGSTEN PRODUCTION

nents. It is actually produced in 30 countries. The world production of concentrates containing 60% WO_3 averaged nearly 10,000 metric tons per year from 1920 to 1930, China being the principal pro-

tribes of Orochon, Manegir, Lamut, etc. VOWEL-HARMONY in Tungus is much more involved than in Turkish and does not affect the suffixes. V. M.

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TUNICAN, a North American Indian linguistic stock comprising a single tribe, the Tunica, which played an important part in the early history of the lower Mississippi region, their ancient habitat. When first encountered they lived on the lower Yazoo River. The survivors of the tribe, never very numerous, in 1931 consisted of a few individuals living near Marks-ville on the lower Red River. Formerly they were chiefly agriculturists, though they also hunted the deer and buffalo. Their social organization and ceremonial life are not known.

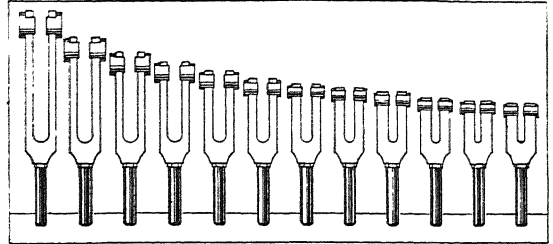
TUNICATES, members of a class (*Tunicata*) of *Protochordates*. There are three orders, *Ascidacea*, *Thaliacea* and *Copekata*. All are sea-dwellers; the ascidians are fixed as adults, and may be found both in shallow water and in the deep sea; the Thaliacea and the Copekata may be found floating or swimming in the open ocean.

Most tunicates are more or less like sacs or gourds or double-necked bottles in shape; only the tiny Copekata have long tails, carried at right angles to the horizontal. They have two siphons, one inhalent, the other exhalent, through which streams of water are constantly passing. The water carries with it small organic particles on which the animals feed. Characteristically they are enveloped in a firm tunic or test of cellulose—a substance common to plants, but seldom found in animals. Some species, such as certain ascidians and Thaliacea, form colonies by budding, while others, sea squirts and Copekata, are solitary. They are hermaphrodites. Asexual reproduction by budding is very common, and is used not only in the growth of a colony, but also for the formation of new free individuals and new colonies. Among the Thaliacea an alternation of sexual and asexual generations is the rule.

Tunicates were long thought to be invertebrate animals, until the discovery that the larval ascidians possess certain structures, such as gill slits and notochords, characteristic of back-boned animals revealed that they are really degenerate Protochordates, allied to Amphioxus, and, more distantly, to the vertebrates. See also ASCIDIANS. A. I. W.

TUNICLE or **TUNIC**, 1, Originally a Roman garment worn by all classes of men. 2, In the Early Christian Church, the same as the ALB, since the 13th century the outer garment of the subdeacon, similar to the DALMATIC and of the same material and color as the CHASUBLE. It is also worn by the cardinal, bishop or abbot under the dalmatic at pontifical Mass. 3, The principal garment of all religious habits of men and many of women, a loose gown reaching to the ankles and, as a rule, having narrow sleeves. With attached cowl, the tunicle forms the characteristic garb of monks and friars.

TUNING FORK, a U-shaped bar of steel or other metal used for producing SOUND of a given fixed PITCH. This pitch may be raised by removing metal from the ends of the prongs and lowered by removing



SET OF ALLOY TUNING FORKS GIVING FREQUENCIES FROM 64 TO 2,048 VIBRATIONS

metal at the yoke. The particular shape of a fork is determined by the frequency desired. Low-pitched forks have long prongs with relatively light yokes, while high-pitched forks have short prongs and heavy yokes.

Tuning forks were formerly made only of mild steel. Recently, it has been found that forks made of special alloys of aluminum and magnesium have all the desirable qualities of steel forks, with the added advantage of less "damping," the rate at which vibration dies away.

The pitch of steel forks lowers slightly with an increase of temperature. Koenig gives the temperature coefficient for them as -0.00011 per vibration per degree centigrade. The damping of steel forks depends upon the mass of the prongs, the tempering of the steel and the dynamical balance of the prongs. Other conditions being equal, the vibration of a heavy-pronged fork will persist longer than that of one with light prongs. P. E. S.

TUNIS or **TUNISIA**, a French protectorate in north Africa, bounded on the north by the Mediterranean, on the south by the Sahara, on the east by the gulfs of Mammamet and Gabes and the territory of Libya, and on the west by Algeria. The area covers some 48,300 sq. mi. Physically the country comprises the extreme end of the Atlas highlands, the adjacent lowlands, an upland region, and the Saharan region of about 21,500 sq. mi. in the south.

Since the establishment of the French protectorate in 1881 many nomadic pastoral tribes have been pacified through a policy designed to foster agriculture and education. Wheat, barley and olives form the chief crops. Dates, citrus fruits and wine are produced and cork, briar-wood and alfa grass provide important exports. The number of domestic animals has greatly increased in recent years. Phosphate, iron ore, zinc and lead are mined, but manufacturing is of only slight consequence.

The principal towns are TUNIS, BIZERTA and Gabes. Tunis is still under the nominal rule of a bey, whose position dates from the period of Turkish control. Since the protectorate was formed in 1881, a resident-general of France governs with the native bey. The

army has French directors, but the ministries of state and justice are directed by natives. Pop. 1926, 2,159,708, including 71,020 French, 89,216 Italians, 8,396 Maltese, 517 Spaniards, 646 Greeks and 3,486 other foreigners, besides a native population of 1,986,427.

Tunis was first settled within historical times by the Phoenicians, who established themselves along the coast-line and founded Carthage, but made no attempt to subdue the native Berbers towards the south. After the Romans conquered the Carthaginians, Latin settlements followed and the land became known as the province of Africa. The province flourished in early Christian times and gave birth to such great ecclesiastical figures as Tertullian, Cyprian and Augustine. The Moslem conquests of the 7th century practically wiped out the North African Church and the Arab conquerors imposed their faith on the Berbers of the interior. The Fatimite dynasty of the 11th century was followed by a brief period of Norman rule under Roger I of Sicily during the 12th century, and was in turn succeeded by various Arabian dynasties until the Turkish conquest during the 16th century. Under the title of *Bey* various Corsican and Cretan adventurers ruled Tunis during the 17th and the 18th centuries until in 1881 Tunis became a protectorate of France. Turkey refused to recognize the status of the French in Tunis, and France was engaged in various frontier troubles with Turkey until the World War. After the war France continued to govern Tunis as one of its important colonies.

TUNIS, the capital of the French protectorate of TUNIS. The city is favorably situated for Mediterranean traffic and lies at the head of the Gulf of Tunis, on a shallow lagoon through which a channel for shipping has been cut. The outlet of Tunis is La Goulette, at the entrance of the lagoon. The remains of many Roman and pre-Roman towns in the hinterland attract large numbers of tourists. The site of ancient Carthage lies about 12 mi. to the northwest. Pop. 1926, 185,996.

TUNKHANNOCK, a borough in northeastern Pennsylvania, the county seat of Wyoming Co. It is situated on the Susquehanna River, 26 mi. northwest of Scranton and is served by the Lehigh Valley railroad. The borough has lumber mills and a witch hazel plant and is a shipping point for leather and lumber. Crossing the Tunkhannock Creek valley is the large TUNKHANNOCK VIADUCT. Pop. 1920, 1,736; 1930, 1,973.

TUNKHANNOCK VIADUCT, largest concrete bridge in the world, bridging Tunkhannock Creek and valley at Nicholson, Pa., 21 miles northwest of Scranton. The Lackawanna Railroad began construction of the viaduct in 1912, and the massive bridge, 2,375 ft. long, was completed in 1915. The double-track roadway is supported by 12 concrete Roman arches, solid ribs of the voussoir type, of which 10 have a span of 180 ft. and two of 100 ft. The roadway is 242 ft. above the valley floor, and the entire structure contains 4,509,000 cu. ft. of concrete and

1,100 tons of reinforcing steel. The structure, higher than a 20-story office building, was constructed before prices of concrete increased due to the World War, a factor which has since made large-scale concrete bridge construction impractical.

TUNNEL, in mining, an approximately horizontal passage driven from the surface of the ground to a mineral deposit. It provides access for development of the mine. Tunnels, also called *Adits*, can be used only when the topography is favorable, as in hilly territory, shafts being used otherwise.

TUNNEL, an underground passage, more or less horizontal, excavated from within and not by *TRENCHING* from the surface. Also the term is less exactly applied to an underground passage built or placed in a previously excavated or dredged trench and covered over; except that in the United States an underground city railway is called a *SUBWAY*.

Tunnels are used for railroad and highway traffic, water supply, sewerage, drainage, canals, and many minor purposes. At depths of more than about 30 feet, tunneling is generally cheaper than open excavation. Usually a tunnel saves a detour or lessens a grade where rapidly rising ground is met; or escapes the alternative of bridging a body of water; or avoids surface disturbances in towns.

The commonest and most adaptable form of cross-section is the "horseshoe" which has an arched roof, straight or slightly concave walls, and a flat or inverted-arch floor. In sound, solid rock, "lining" is often omitted; but water tunnels, unless short, are usually smoothly lined with concrete, and when under pressure, are generally circular. The circular form is common for shield-driven tunnels (*see TUNNELING*), through soft ground. They ordinarily consist of a cast-iron shell, composed of segmental rings bolted together, made watertight and lined inside with concrete. Special forms are the result of special methods of construction. Formerly, tunnel masonry was of brickwork, but now, in some instances, concrete blocks (*see CONCRETE PRODUCTS*) are used.

Of noted mountain railway tunnels, the longest is the Simplon, 12.3 miles, under the Alps, opened in 1906. Among others in the Alpine group are the Mt. Cenis, 7.98 miles; the St. Gotthard, 9.3 miles; the Arlberg, 6.36 miles; and the Loetschberg, 9.04 miles. In America, the longest railway tunnel is the new Cascade, 7.79 miles long, opened in 1929; and among others are the Moffat, Colo., 6.1 miles; the Connaught, Canada, 1916, 5 miles; and the Hoosac, western Massachusetts, 4.7 miles, for years the longest in America. The world's longest true tunnel is the Shandaken built in 1926, 18.1 miles long, forming part of the New York City water-supply system, but its length will soon be exceeded by one under construction in 1932 for the same system.

Well-known examples of shield-driven tunnels are those under the Hudson and East Rivers at New York and the London Underground tubes. The Holland Tunnel under the Hudson, opened in 1927, has two tubes, each providing a 20-foot roadway for two

lanes of motor traffic. The tubes are of cast iron, 29 feet in outside diameter, driven by shield under compressed air. More than 50,000 vehicles have used the tunnel in a single day. The cost was about \$48,000,000.

Of tunnels built by special methods, those under the Detroit River, sunk in a trench, are noteworthy; as is also that under the Seine at Ile de la Cité, which was sunk by CAISSONS. The tunnels under the Chicago River are examples of the coffer-dam method.

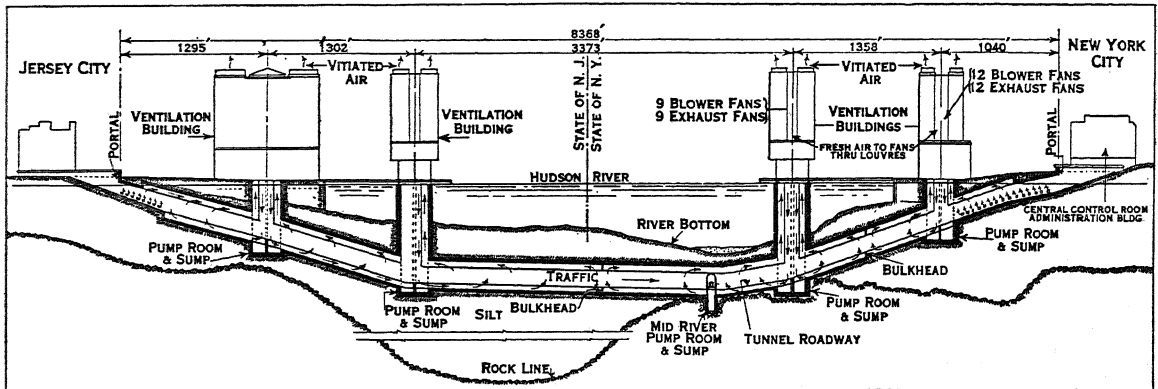
Of numerous tunnels for canals, the greatest in size is the Rove, opened in 1927 at Marseilles; it is 72 feet wide, 50 feet high and 4.5 miles long. The Tequiquiac tunnel, opened 1900, draining Mexico City, is 6.2 miles long. The Gunnison irrigation tunnel, Colorado, built in 1909, is 5.8 miles long.

The rock gallery leading to the tombs of Seti I and Rameses III in the Valley of the Kings, dates from 1300 B.C. or earlier. The Romans dug tunnels for

the roof only, were used extensively for the subway tunnels. The shield was first used in 1825 by Marc Brunel for the first Thames tunnel.

In wet ground, when pumping proves impracticable, compressed air is generally employed to overcome water pressure and permit excavation "in the dry." The compressed air is confined to the working section by BULKHEADS in which are set air-locks for the passage of men and materials. Air-locks are short tubes with a door at each end opening against the air pressure, so that either door, but only one at a time, can be opened after the pressure on each side is equalized. In subaqueous tunnels a "blow-out" occurs when the earth covering the heading becomes ruptured, permitting a sudden outrush of air and partial or complete flooding of the working chamber.

With the trench method, first developed for railroad tunnels, a trench is dredged (*see DREDGING*), and bearings set at the tunnel subgrade. Sections composed of steel tubes, one for each track, are framed



COURTESY PORT OF NEW YORK AUTHORITY

CROSS-SECTIONAL VIEW OF THE HOLLAND TUNNEL JOINING LOWER MANHATTAN, NEW YORK CITY, AND JERSEY CITY

water supply, roads and drains. Lake Fucino, 50 miles east of Rome, was drained by Emperor Claudius about 52 A.D. by means of a tunnel $3\frac{1}{2}$ miles long. The work is said to have occupied 30,000 men for eleven years.

F. C. N.

TUNNELING methods vary widely. If wholly in firm rock, timbering may be omitted; otherwise, temporary support is needed until the "lining" is placed. Rock TUNNELS are advanced by one or more headings followed by enlargement to full size. Speed and economy in tunneling gained greatly after the introduction, at Mt. Ceniz in 1861, of machine rock drilling, and later, of improved explosives and drilling methods. More recent improvements are mechanical loaders for "spoil" and parallel pioneer tunnels with cross-drifts for simultaneous attack at several points. Special difficulties of deep tunneling sometimes are springs, bursting rock or excessive heat. The "shield" is frequently employed in soft ground. This is a steel shell, the rear of which overlaps the front end of the tunnel. It is "jacked" ahead as the excavation is made, thus affording a shelter while the lining is placed. In Paris and Boston partial shields, covering

together on shore and bulkheads are set at the ends. It is towed to the site, and sunk by admitting water. Each section is connected to the preceding one. Concrete is deposited under water about the tunnel, after which it is dewatered and lined.

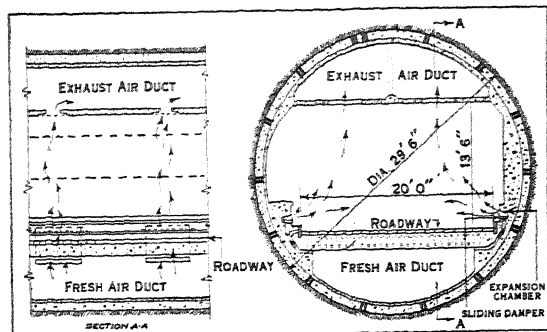
The CAISSON method is not often used but is of advantage in certain situations. It consists, in principle, of sinking a tunnel section while excavating beneath it within a compressed-air chamber. With the coffer-dam method, a section of tunnel is built in a tightly sheeted trench, the water being kept down by pumping.

F. C. N.

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TUNNEL VENTILATION. Where tunnels are not too deep, natural ventilation through frequent roof-openings generally suffices. Otherwise, mechanical DRAFT is often required, even for a tunnel of no great length if steam locomotives are used. Foul air may be exhausted by FANS at one or more intermediate shafts, or fresh air may be forced in. To assist mechanical draft, the portal may be closed by a door after the train has entered. With the *Saccardo* sys-

tem, as applied to long tunnels with steam traction, air is forced *in* at the portal through a narrow space about the circumference of the TUNNEL at such velocity that a draft in the same direction is "induced."



TUNNEL CROSS SECTIONS, SHOWING FEATURES OF CONSTRUCTION AND SYSTEM OF VENTILATION

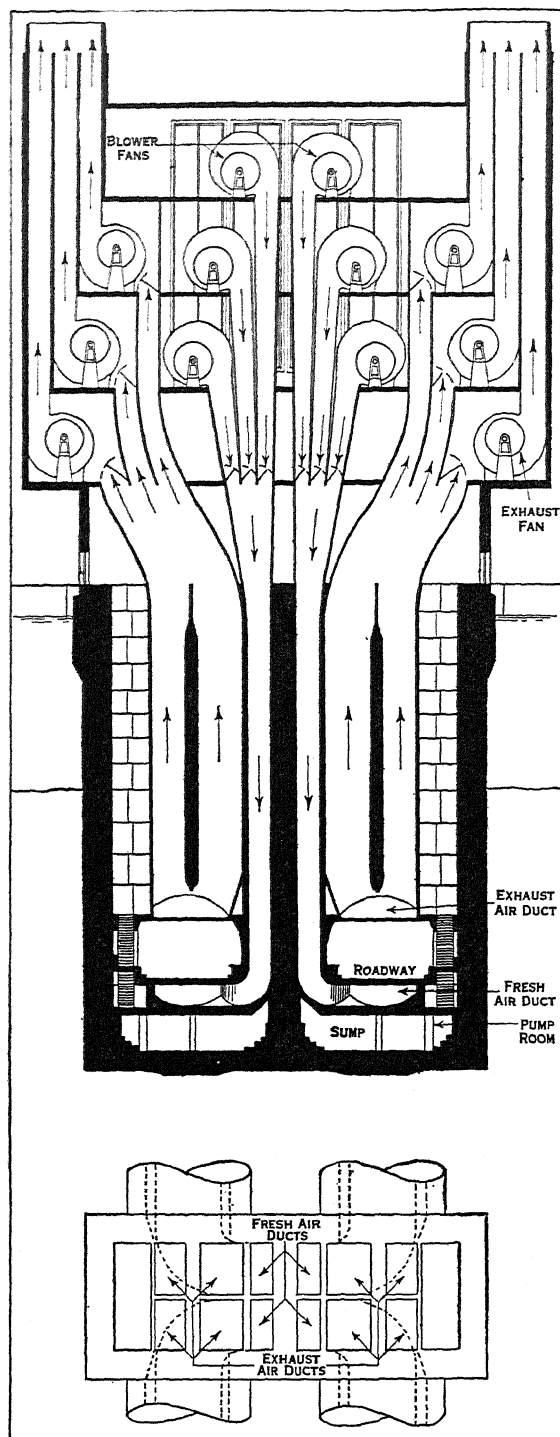
A transverse system was adopted in the Holland Tunnel, air being forced in through a duct beneath the roadway to escape at openings at each side above the pavement, carrying with it the exhaust fumes from automobiles. The mixture is drawn through openings in the ceiling into an exhaust duct at the top, from which it is discharged at either end of the tunnel through special outlets.

F. C. N.

TUNNY, a very large oceanic game fish (*Thunnus secundodorsalis*) of the MACKEREL family (*Scombridae*), found along the Atlantic coast from New York to Nova Scotia. It reaches a length of 10 ft. and sometimes weighs 700 lbs., though it is reported to attain much greater size. In appearance it is mackerel-like, with strikingly beautiful coloration, steel blue above, silvery below, with iridescent hues on the sides and yellowish fins. It feeds chiefly on smaller mackerel, menhaden and squid. Its flesh, though somewhat oily, is utilized for food. Very similar in size and habit is the great tunny (*T. thynnus*) of European coasts, known as horse-mackerel in Great Britain and as tuna in Spain, much prized as a sport fish. The leaping tuna (*T. saliens*), made famous by Santa Catalina sportsmen, is found on the Pacific coast from Lower California to Oregon. Skillful anglers, with a hand rod and reel, have taken specimens weighing 250 lbs., by tiring the fish in a long chase and landing it with a gaff. Whether these three tunnies are different, or in fact one and the same species, is a matter of opinion.

TUOLUMNE, a name applied collectively to the North American Indian tribes of the Moquelumnan or Miwok linguistic stock, living on the Tuolumne River in California.

TUPAC AMARU (c. 1740-1782), Peruvian revolutionary leader, believed by the Indians to be a direct descendant of the Incas. Desirous of freeing his people from the Spanish rule, he organized a revolutionary movement which spread from Peru to Buenos Aires. For some two years Tupac Amaru maintained himself and a numerous army against the



COURTESY PORT OF NEW YORK AUTHORITY

METHOD OF VENTILATION OF THE HOLLAND TUNNEL
Showing (above) a section of a typical river ventilation building and (below) a plan of the air ducts from above

Spanish forces, and at one time besieged Cuzco, but failing in this siege he retired to the mountains where he was defeated and later captured. Brought to trial in Cuzco, he and nine of his companions

were condemned to death. The revolution continued for another year, but failed, and was the last serious attempt made by the Indians to drive the Spaniards out of South America. He died in 1782.

TUPELO (*Nyssa sylvatica*), a handsome tree of the tupelo family (*Nyssaceæ*), called also black gum and pepperidge. It grows chiefly in wet soils, especially in borders of swamps, from Maine to Michigan and southward to Florida and Texas. The tree, usually medium sized, occasionally grows 125 ft. high, with a trunk sometimes 5 ft. in diameter, bearing flexible, horizontal branches, oblong leaves, inconspicuous flowers and a dark blue, fleshy fruit (drupe). In the southern states the soft, strong, yellowish wood is cut in limited quantities for lumber. The tupelo is the first tree in the eastern states to display autumn coloration, becoming brilliant red after the earliest frosts.

In 1930 the total cut of tupelo lumber in the United States amounted to 254,386,000 bd. ft., valued at the mill at \$5,970,439. To this total footage Louisiana contributed 39.3% and South Carolina 16.6%.

TUPELO, a national monument near Baldwin, Mississippi, commemorating the Civil War battle of Tupelo, fought in July 1864. The monument was established Feb. 21, 1929 under the administration of the War Department and is reached via the Mobile and Ohio Railroad.

TUPELO, a city in northeastern Mississippi, the county seat of Lee Co., situated on the West Fork of Tombigbee River, 105 mi. southeast of Memphis, Tenn. It is served by bus lines and two railroads. Cotton and corn are the chief crops of the vicinity. The principal manufactures are cotton textile and clothing, cotton-seed oil products, fertilizers and dairy products. The city is the seat of Tupelo Military Institute and Lee County Training School for Negroes. Tupelo was incorporated in 1870. The Amory natural gas fields, 20 mi. west, supply the city with gas. Pop. 1920, 5,055; 1930, 6,361.

TUPI, one of the most important of the South American linguistic stocks. When the Portuguese took possession of Brazil in the early 16th century, Tupian tribes inhabited the coastline from the Rio de la Plata north to the Amazon as well as much of inland Brazil, Uruguay and Paraguay. The Tupians were agriculturists, chiefly of fixed abode, and lived in large, lightly constructed communal dwellings.

Hunting and fishing were also important sources of procuring food. Clothing was always scant but they decorated their bodies extensively with feather ornaments, paint and tattooing. The Tupian tribes were fierce and warlike and made a common practice of eating prisoners. The tribes around the mouth of the Amazon were known collectively as Tupi; those in lower Paraguay as Guarani. Other important Tupian tribes were the Chiriguano, Guarayo, Mura and Omagua. The language of the Guarani was used by the Jesuits in all their mission work in Paraguay and a corrupted form of Tupi is now the trade medium or "Lengua geral" of the Amazon.

At present, the Tupians, widely mixed with Europeans and Africans, form the bulk of the country population of Brazil, Paraguay, northern Uruguay and northeastern Argentina.

TUPPER, SIR CHARLES (1821-1915), Canadian statesman, was born in Amherst, N.S., July 2, 1821. He was educated at Edinburgh University, practiced medicine in Cumberland Co. for 12 years; entered politics and served as premier of Nova Scotia, 1864-67. He took a prominent part in the Confederation movement as a delegate at the Charlottetown, Quebec and London Conferences, and in answering the campaign of JOSEPH HOWE. He was chiefly responsible for securing Nova Scotia's adhesion to Confederation in 1867. He was a member of the Dominion parliament from 1867 to 1884, 1887 to 1888, and 1896 to 1900. As minister of railways and canals, 1879-84, he was influential in the arrangements for building the Canadian Pacific Railway. Later he was one of the representatives at the Fisheries Convention at Washington, 1887. During his last term he was leader of the Conservative Party and for a few months in 1896 prime minister. Tupper also served for a time as High Commissioner for Canada in London. Following his failure to be re-elected in 1900, he retired to England where he died in 1915, the last of the "Fathers of Confederation."

T. P. P.

TUPPER LAKE, a village in Franklin Co., northeastern New York, situated on Big Tupper Lake, 100 mi. northeast of Utica. It is served by the New York Central Railroad. The village is surrounded by a large tract of hardwood timber. The chief local manufactures are furniture and wooden products. Located here are a United States Hospital for War Veterans and the American Legion Mountain Estate. The region is dotted with many charming lakes, summer cottages, fine estates and resorts. Pop. 1920, 2,508; 1930, 5,271.

TURBINES, STEAM. The steam turbine, like the water turbine (*see* TURBINES, WATER), utilizes the kinetic energy of fluid in motion. Whenever a moving fluid impinges on moving vanes which change the direction of flow and reduce the velocity of the fluid, the energy of the fluid is converted into mechanical work and is available through the shaft on which the moving vanes are placed.

In the steam turbine the process of converting the thermal energy of steam into mechanical energy is identical with that in the STEAM ENGINE, except that the flow of steam is continuous instead of intermittent. The steam engine may be termed a ratchet mechanism, while the steam turbine is a continuous mechanism. The difference in form of the turbine and engine is due to the fact that the turbine is designed to work mostly by changing the direction of motion of the flowing steam, i.e., using the momentum, while the engine is designed to operate by the direct static pressure of the steam. The turbine is thus a velocity motor and the steam engine a pressure motor.

Turbines where the velocity of steam is produced in standing blades or nozzles belong to the so-called *impulse* or *velocity* type, while turbines with steam accelerated in the moving blades are called *reaction* turbines. Actual turbines fall in between the two extreme types and differ according to the degree of reaction. The higher the degree of reaction the greater is the axial thrust for balancing of which special means are adopted.

Turbines may be further classified into small turbines, used chiefly for driving auxiliaries, and large turbines. Small turbines are built in sizes up to 750 horsepower, or 500 kilowatts, large turbines commencing at this size and going up to the limit of mechanical construction, which at present may be from 100,000 to 160,000 kilowatts or larger on a single shaft. Turbines with two shafts and two generators have been built with a capacity as high as 160,000 kilowatts, and those with three shafts and three generators with a capacity as high as 208,000 kilowatts.

Large turbines are usually classified by the names of their inventors and the following types may be distinguished: Parsons, DeLaval, Curtis, Rateau, Zoelly, Loesel and Ljungstrom. All of these turbines are very much alike in principle, but differ widely in mechanical design and in construction.

The *Parsons* turbine was the first of the large turbines to be successful and is now manufactured in both Europe and America. The construction is of the drum type in which the blades are fixed in grooves on the outside of a cylindrical drum to form the rotor, the stationary blades being held in grooves on the inside of the casing. Some manufacturers are using rotors of solid forgings or built up of forgings instead of the usual drum construction.

All Parsons turbines are full-intake machines and require about 80 rows of blades, 40 fixed and 40 moving, for complete expansion from a pressure of 200 pounds per square inch to 28 inches of vacuum. No glands are necessary to prevent leakage between the stages, as the pressure differences are quite small, as are also the clearances at the ends of the blades. Each manufacturer of Parsons turbines varies the design in minor details, such as the type of thrust bearing, location of "dummies," type of blading and mechanical construction of the drums and casings.

The *Rateau* turbine is of the partial-entrance type and so-called multicellular construction. The guide blades are held in diaphragms with glands to prevent leakage where the shaft passes through them, while moving blades are dovetailed on discs keyed to the shaft. About 20 stages are usually used for the range of expansion between a 200-pound pressure and a 29-inch vacuum.

The *Curtis* turbine, which originated in America, has been classed as the "multiple-velocity-stage" type. It always has partial intake and from three to six stages are necessary for the expansion from a 200-pound pressure to a 28-inch vacuum. The particular feature of this type is that in each expansion stage two or more velocity stages may be used. The early construction

is somewhat similar to the Zoelly machine, with the exception that the shaft has been placed in a vertical position, the weight being supported by a step bearing. The clearances in this machine can be very generous, as they are in the Zoelly and Rateau types. The diaphragms between the stages are provided with a gland where the shaft passes through them, thus preventing leakage from stage to stage. The vertical-shaft turbine is now obsolete but many smaller turbines with horizontal shafts of this type are still being manufactured.

The *DeLaval* type is best represented by the single-wheel type working between 200 pounds and 28 inches of vacuum. The *Loesel* type is characterized by exceedingly small pressure drops per stage and a rotor construction in which the blades are mounted on discs machined out of the solid shaft forging, the construction often running to 80 or 100 stages between a pressure of 200 pounds and 28 inches of vacuum. The nozzle construction is milled out, allowing a fine finish.

The *Ljungstrom* turbine differs materially from the other types of large turbines. It is a radial-flow machine, in which the steam is admitted through the center of the shaft and passes through the blades in a radial direction to the condenser. There are no fixed blades, but two sets of working blades moving in opposite directions. By this means bucket speeds may be kept high with reasonably low shaft revolutions. Test results of this machine are extremely good and machines as large as 50,000 kilowatts are running, while larger machines are on the market.

The *Parsons*, *Zoelly* and *Rateau* constructions seem to give much better results in that part of the expansion between atmospheric pressure and 28 inches of vacuum. The Curtis and Rateau types appear to give a trifle better result in the part of the expansion between a pressure of 200 pounds and atmospheric pressure. When these facts became known some manufacturers started building what may be termed the composite type of machine, using a Curtis wheel for the first stage and the Parsons, Zoelly or Rateau machine for the low-pressure end. This construction resulted in a shorter, stiffer and cheaper machine and the efficiencies obtained were extremely good. Shortening the machine and decreasing the number of stages enabled the manufacturers to build machines of a size much larger than that permitted by the old type of construction, and the simplified wheel construction enabled higher speeds to be used with attending economies.

Present-day machines, however, are rarely, if ever, consistently of one of the foregoing types, and the manufacturers have taken advantage of the expiration of patents as well as of cross-licensing to develop machines of composite type. There seems to be very little difference in economy or price between turbines of different types and makes, and in general there is little difference in economy between machines with as few as 14 stages and as many as 60 stages. Large turbines with fewer stages than 14 have been built,

but there has been some doubt of their economy as compared with machines of a larger number of stages.

The governing of all full-intake machines is of the throttling or "puff" type with overload by-passes, while the governing of the partial-intake machines is almost entirely of the nozzle type, that is, the steam is admitted at full pressure to one or more nozzles, depending on the load on the turbine.

Small turbines are of many types, but may be classified both by the construction and by the method in which the steam is used in the wheel. In the *DeLaval* type, the steam is expanded in the nozzle and is passed once through the buckets of a single wheel. This was the first successful turbine and has been used to a great extent. It naturally leads to high bucket speeds and in the small sizes to a very high speed of rotation, in some cases higher than 12,000 revolutions per minute. In order to make this turbine usable, a special reduction gearing was developed for reducing the speed.

Some years later in Germany the *Riedler-Stumpf* turbine was developed, in which the steam, having been expanded in the nozzle, was passed through the wheel buckets a number of times by a number of return channels situated behind the jet. In the United States, Terry provided ventilating return passes, improving this machine to such a point that it has been widely built.

In the *Curtis* type a wheel is provided with two or more sets of blades and the steam is used a number of times by the same wheel, each velocity stage using a portion of the jet velocity.

In the "*Electra*," or Westinghouse type, the steam, having passed once through the buckets of the wheel, is caught by a passage on the opposite side of the blade which returns it to the wheel on the discharge side and passes it through the buckets in a direction contrary to the first pass.

In the *Kerr* type the buckets were similar to those of the Pelton water-wheel (see TURBINES, WATER), and the steam is used only once in a set of buckets. This necessitates a number of stages when economy is to be secured.

The original *DeLaval* buckets were symmetrical, impulse-type blades with a projection at the top and bottom that formed a housing. The earlier machines had discs made in halves with the dovetailed roots of the buckets held firmly between them. But DeLaval found the floating shaft, with the disc revolving on its center of gyration, of such value that the solid disc was soon used with the blades dovetailed axially. This proved to be a much more satisfactory construction. The first DeLaval turbines in the United States of 300 horsepower were put in use in 1893, and ran successfully.

All small turbines are of the "partial-entry" type. The ordinary machines are throttle governed, but the better and larger ones may be nozzle governed. Only a few of the small machines are of the "full-entry" type with throttling governors, following the practice in the large machines.

Casings are usually symmetrical with two exhaust nozzles to avoid right- and left-hand machines. Many manufacturers have developed pump and blower units in which both driver and driven casings have been combined; thus, two-bearing and three-bearing units are common. Thrust bearings and flexible couplings of excellent design are used. Governors are chiefly of the plain centrifugal type, being mounted directly on the shaft, while on the larger machines the *Jahns* governor or similar types located on the same shaft as the oil pump and driven by worm gears, are in vogue. Emergency-stop governors are also provided.

Many of the later small turbines are designed along *Rateau* lines and multi-stage machines are now common. In general, the type differences are becoming much less marked as the earlier patents expire and are thus thrown open to general use. Most of these machines are now built in from one to eight stages when of larger size or when used condensing. Small turbines are being used now quite extensively for driving auxiliary mechanisms like fans, and pumps.

Many industrial plants with large demand for process steam of moderate pressure use the so-called back-pressure turbines which take high pressure steam from the BOILERS and exhaust it into low pressure process steam mains. They are also called "reducing-valve turbines" and are often governed to maintain a definite back pressure while generating variable amounts of power. Many industrial turbines are built for steam extraction, where a fraction of steam is drawn out between the stages to be used for processes, while large power station turbines are "bled" in several points the extracted steam being used for feed water heating in the REGENERATIVE CYCLE.

The efforts of steam-turbine designers are now directed toward proper balancing of the rotating masses to eliminate vibration, toward the design of more efficient buckets and toward attainment of greater stability in the last rows of long blades which are subject to RESONANCE vibration. Serious attention is being given to the blade material which is affected by the high temperatures of steam in the inlet part and by the erosive action of wet steam in the outlet part.

G. A. O.

TURBINES, WATER, machines which convert the kinetic energy of flowing water into mechanical ENERGY, comprising, essentially a runner, or radial blades mounted on a rotating shaft and enclosed by a casing. The force of the water as it strikes or passes over the blades drives the runner and rotates the shaft. These machines are the principal form of hydraulic PRIME MOVERS. See also TURBINES, STEAM.

Water turbines are divided into two general classes, *impulse* and *reaction*. The runner of an impulse turbine is acted upon by one or more jets of water issuing from nozzles under a head of water at full spouting velocity. The runner of a reaction turbine is acted upon by a mass of flowing water, filling all the passageways and guided into them under pressure at less than spouting velocity. During the passage of the water through a reaction runner its pressure

decreases, becoming less than atmospheric pressure as the water leaves to enter the DRAFT TUBE.

The Pelton waterwheel established the type of all modern impulse turbines. The runner is a steel disc with curved buckets attached to the rim to receive the impulse from the jets of water striking them at high velocity. The turbines of the plant having the highest head in the world, 5,380 feet, located at Lac Ffully, Switzerland, are of the Pelton waterwheel type. The most powerful Pelton runners are in the Vermunt, Austria, plant, each developing 33,250 horsepower from a single jet under a 2,340-foot head.

Modern reaction turbines are either of the Francis, or of the propeller type. Water enters a Francis runner inwardly toward the shaft between curved radial blades and is so deflected by a curved disc, called the crown plate, that it leaves the runner in the general direction of the shaft. Water enters a propeller runner generally parallel to the shaft, impinges upon very slightly curved blades and leaves in the same general direction. The blades of a propeller runner can be arranged to rotate about individual shafts set radially to the runner shaft, such runners being called adjustable-blade or Kaplan type.

The highest head under which a Francis runner operates is that of the Vermork, Norway, plant, but that will be soon surpassed by the 1,190-foot head of the 7,500-horsepower turbines to be installed at Zappello, Italy. The most powerful turbine runners will be of Francis type for the Diablo plant near Seattle, Washington, each to develop 90,700 horsepower under a 327-foot head. The greatest head under which propeller runners have been used is 66 feet and the most powerful runners will be the adjustable-blade type to be used in the Safe Harbor, Pa., plant, each to develop 42,500 horsepower under a 55-foot head. The turbines of largest diameter, 276 inches, are the governor adjusted-blade propeller type of the Ryborg-Schworstadt plant, Germany. See also HYDRAULIC MACHINERY. F.K.

TURBOT, (*Rhombus maximus*), a flat fish, generally found in deep waters close to the bottom along the eastern Atlantic coast and in the Mediterranean, is famous as one of the most delicious European food fishes. Its large, brownish body, deep and narrow, weighs from 30 to 50 lbs. The turbot can be identified by its large mouth, scaleless skin, dotted with hard tubercles on the left side, as well as the location of both eyes on this side. Other fish form the main diet of the turbot.

TURCO-MONGOL-TUNGUS, a LINGUISTIC FAMILY formerly considered part of a "Turanian" or "Ural-Altaic" group to which FINNO-UGRIC, Samoyed and many other Asiatic languages were supposed to belong. Better knowledge of the latter, however, and elimination of elements borrowed on either side render this older view nugatory. The family is characterized by immutability of the stem, absence of prefixes, modification of meaning by suffixes agglutinated to the stem one after another (see AGGLUTINATION), and progressive VOWEL-HARMONY. Regular

correspondence of sounds is also shown in each of the three languages of the family, e.g., Mongol *boru*, "gray," *ükür*, "bull," *aral*, "shaft of a cart," *düli*, "half" = Turkish *boz*, *öküz*, *arysh*, *tüşh*; Mongol *aluqa*, "hammer" = Tungus *paloa*, *xaluqa*, *folxo*; Mongol *ula'an*, "rod" = Tungus *xula*, *fulaxun*.

V. M.

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TURENNE, HENRI DE LA TOUR D'AUVERGNE, VICOMTE DE (1611-75), French marshal, was born at Sedan, Sept. 11, 1611. At 14 he began to learn the rudiments of warfare in the camps of his uncles, Maurice and Henry of Nassau, and joined the French forces in 1630. He began his career in the THIRTY YEARS' WAR in Lorraine and northern Italy, in 1643 receiving command of the Army of the Rhine. Two years later, after effecting a union with the Swedes, Turenne defeated the Bavarians at Zusmarshausen. In 1654 he repelled the Spaniards at Arras. His capture of Dunkirk in 1658 made possible the PEACE OF THE PYRENEES, and in recognition of his services he was made marshal. On the resumption of the Spanish War, Turenne in 1667 conquered French Flanders. At this time he abjured Protestantism and became a Catholic. In the Dutch War, 1672, he was again successful, forcing the Elector of Brandenburg, the ally of the Dutch, to make peace. In 1674 he perpetrated the devastation of the Palatinate and conquered Alsace. He was killed at Sassbach, near Offenburg, July 27, 1675, on the eve of his engagement against the Austrian general Montecuculi.

TURGENEV, IVAN SERGYEEVICH (1818-83), Russian novelist, was born in Orel, Oct. 28, 1818, of a noble family. He studied at the universities of Moscow and St. Petersburg, and finished his education abroad. With this background, he commenced the literary career that was to make him a key figure in Russian literature. His works have become classics and exhibit an artistry in language, a gift at picturing and a range of emotional expression that have played an important rôle in the cultural growth of Russia. Turgenev's short stories, permeated with melancholy, are filled with little studies that in mass make up a replica of the age. The stories and sketches in *A Sportsman's Sketches*, 1852, were instrumental in freeing the serfs. *A House of Gentlefolk*, 1859, is a novel of Russian life in its many aspects, town and village, high and low, bureaucrat and idealist. *FATHERS AND SONS*, 1862, depicts the intellectual struggle and ultimate tragedy of a young Nihilist. *Virgin Soil*, 1877, is a long novel picturing the intellectual revolutionists of the "back to nature" type. Among Turgenev's other novels are *Smoke*, *Rudin* and *On the Eve*.

Giant Russia begins to heave in Turgenev, and its rumblings are heard in his pages. The classical polish of his literary art and his psychological insight into the springs of human conduct, assist in the delineation

of a peasant humanity set in a complex background of social classes and movements. Turgenev died near Paris, Sept. 4, 1883. See also RUSSIAN LITERATURE.

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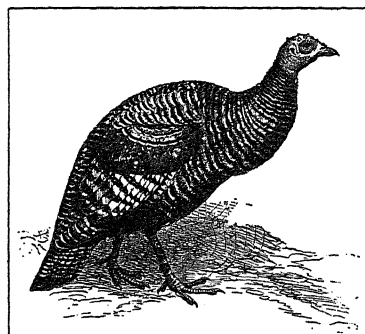
TURGOT, ANNE ROBERT JACQUES, Baron de Laune (1727-81), French statesman and economist, was born at Paris, May 10, 1727. After studying for the Church, he turned in 1750 to law and political economy, and in 1752 was attached to the French parlement as councillor. From 1761 until 1774 he was intendant of Limoges, where he instituted fiscal and economic reforms. In 1774 he was called to Paris as minister of marine, later in the year being named comptroller-general. In this office he made drastic efforts to win Louis XVI and his government to a policy of financial reform, summing up his advice to the King in the words, "No bankruptcy, no increase in taxation, no borrowing." If his reforms had been accepted the country might have been saved the horrors of the Revolution, but his stringent economics and far-reaching abrogation of privilege antagonized the court, and in May 1776 his resignation was requested. His published works include *Sur la législation et le commerce des grains*, 1775, and *Réflexions sur la formation et la distribution des richesses*, 1769, his most celebrated work. He was an exponent of free trade and maintained that land is the only source of wealth. He died at Paris, Mar. 18, 1781.

TURIN, a city of northwestern Italy, situated in Piedmont, on the river Po; next to Milan it is the most important industrial and commercial center in Italy. Turin occupies the site of a Roman town, and is still laid out in Roman regularity. There are a number of palaces and other buildings of the 16th and 17th centuries and a Renaissance cathedral of the late 15th century. Its present importance is due largely to the factories whose wheels are turned by hydroelectric power from the Italian Alps. Historically the chief town of Piedmont, Turin was the capital of Italy from 1860 until 1865. The modern city is the center of the automobile industry of Italy, and is an important silk market; other leading manufactures are gloves, wool textiles and artificial silk, airplanes, leather goods, machines and chemicals. Pop. 1931, 597,260.

TURKESTAN or **TURKISTAN**, the name given to regions in central Asia, generally applying to either that division of Russia comprising the provinces of Syr-Daria, Samarkand, Ferghana, and Semirychensk called Western or Russian Turkestan, and to a dependency of China, sometimes called Kashgar, part of the province of Sinkiang. This region is known as Eastern or Chinese Turkestan. Chinese Turkestan occupies the basin of the Tarim and is separated from Mongolia by part of the province of Kansu. It is a tableland with a desert in the interior but some oases are highly cultivated. Eastern Turkestan, part of the empire of Gunghis, became a possession of

China in the middle of the 18th century. A rising of the Mohammedan inhabitants took place in 1864 and the country was independent till 1877 when the Chinese resumed possession. Russian Turkestan is a government of the Soviet republic of Russia. Deserts or very dry steppes and mountains occupy most of the region; the fertile areas, where most of the population is found, cover less than 15% of the surface. Placer gold occurs and some copper deposits. In the 8th century Arabs besieged western Turkestan, then overrun by Mongol hordes. Tamerlane made it part of a great empire, but after this was split up the Persians and the Afghans took possession of several districts, until the Russians entered about 1864.

TURKEY, an American bird, the two species of which belong to the family of *Meleagridæ*. Least well-known is *Meleagris ocellatus*, the beautiful peacock-like ocellated turkey of Yucatan, Guatemala and British Honduras. The North American wild turkey is *Meleagris gallopavo*, the magnificent bronze bird which once abounded in New England and along the northern Atlantic seaboard. Five subspecies are recognized of which the eastern turkey was formerly



OCCELLATED TURKEY
A Central American species

found from the Gulf Coast to Maine but which has been exterminated in New York and New England. The Florida bird is smaller and darker, the Mexican bird much grayer, especially the bands on the rump and tail. It is from this race that the domestic turkey is supposed to have been derived.

The domestic turkey, largest of all gallinaceous birds, was introduced into Europe by Spaniards early in the 16th century, although the first English explorers probably also brought back live specimens. Since then these birds have been raised for the table in both hemispheres. There is no proof that turkeys were known in the Old World before the discovery of North America, nor is it understood how the birds received the names of turkey-cock and turkey-hen.

Wild turkeys nest on the ground, where 12 creamy eggs are laid each year. The female rarely raises a second brood. The young are the prey of many enemies and few survive. In domestication, turkeys are quite difficult to raise, requiring wide range and protection from dampness and disease.

TURKEY, a republic partly in Asia Minor and partly in Europe. The official figures give the Turkish Republic a total area of 294,491 square miles, with 285,235 sq. mi. or 96.8% in Asia Minor and 9,256 sq. mi. in Europe. The Asiatic part sometimes is called Anatolia; the European, Thrace. In Europe, Turkey borders on Bulgaria and Greece. The Aegean and Mediterranean seas and Syria and Iraq lie to the west and south; Persia is to the East, and Armenia, Georgia and the Black Sea form the northern boundary. The outlet of the Black Sea through the Bosphorus, the Sea of Marmora and the Dardanelles form the boundary between Turkey-in-Europe and Turkey-in-Asia.

Physical Features and Climate. Most of Turkey is a plateau, sloping toward the seas on the north and west, with ridges increasing in number and height toward the east. The country contains a number of rivers which furnish water for irrigation, but of these none are navigable for large ships. Turkey has a normal range of climate for its latitude and longitude, with June, July and August as the dry months and a large part of the rain coming in the spring. The central plateau region gets less rainfall, as a rule, than the Black Sea coast, and semi-desert conditions develop toward the south and southwest. The temperatures run higher in summer and lower in winter in the central areas than along the seas.

Population. A census taken in 1927 gave a total population for Turkey of 13,648,270. Of the inhabitants 1,040,669 were in European Turkey, and the rest, 92.4% of the total, were in Asia Minor. Formerly, the population of Turkey included large numbers of many different races. As a result of the World War, and of an exchange of populations, chiefly with Greece, carried out in accordance with the Lausanne Treaty of 1923, most of the non-Turk elements have been eliminated. The strictly Turkish population now is 86.3% of the total. Kurdish tribes living in the mountainous country bordering on Persia are 8.7%. No other racial group is as much as 1.0%. The largest city still is the old capital, formerly called Constantinople and now known as Istanbul, with 673,029. Izmir, formerly called Smyrna, comes next with 153,845; the new capital, formerly Angora and now Ankara, is third with 74,784 and Adana fourth with 72,652.

Agriculture. Although Turkey is primarily an agricultural country, the land under actual cultivation in 1927, not including vineyards and fruit and olive orchards, was only 9,906,000 acres or 4.9% of the total area. This was a drought year, however. Most of the cultivation is of cereals. In 1927 these were being grown on 89.6% of the cultivated land, while leguminous plants took 4.0% and industrial plants such as tobacco and cotton got 6.4%. The same year 51.4% of all the cultivated land was devoted to wheat. Barley came next, with 23.2%. The total value of the agricultural crops was Turkish pounds 336,932,000, of which the cereals made up 69.6%,

the industrial crops 27.2% and the leguminous crops 3.2%. On the farms are 9,145,000 people, 66.9% of the total. The cereals crops, however, form only about three-quarters of the country's needs, the balance being imported. Cotton production in 1929 was 30,000 metric tons, and tobacco production 90,389,000 pounds. Figs, raisins, nuts, olive oil and sugar beets were important minor crops.

Industry and Mining. Turkey has comparatively little modern industry, though rug and carpet making and other home industries are fairly well developed. The 1927 census listed 18,597 factories, employing more than three million people. The industrial production was valued at £T 432,741,000, of which 65.0% was agricultural products and 17.7% textiles. Tobacco, match, salt and petroleum monopolies are maintained, from which the Government draws substantial revenues. By tariff protection and direct encouragement, the Government is seeking to develop industry. The mineral resources of Turkey, particularly in coal, iron, copper and chrome, are fairly large, though as yet little has been done to develop them on a modern scale.

Communications and Trade. Prior to the beginning of the Republic, in 1920, Turkey had only about 2,500 mi. of railways, most of which were built under concessions to foreigners. At the beginning of Sept. 1931, there were 4,050 mi., with another 550 mi. under construction. The lines connect Ankara with Istanbul and thence into western Europe, and link Izmir with the principal cities to the south and east. There are 17,000 mi. of fairly good roads.

Imports in recent years regularly exceeded exports, though in 1930, after the new tariff came into effect, the balance was the other way. The 1930 trade figures were: imports, £T 147,534,361; exports £T 151,480,382. Cotton and cotton goods are the most important import item, with metals and machinery coming a good second. Tobacco is the chief export item, with fruits and vegetables next.

Finances. The Republic inherited a heavy burden of debt from the Ottoman Empire. Part of this, by agreement with the creditors, was transferred to former parts of Turkey, but on May 15, 1929, Turkey's share was £ Sterling 84,578,000. Payments are being made on this under a 1928 agreement. The Government in recent years has succeeded in keeping the budget balance at approximately £T 200,000,000 in spite of the sharp fall in the exchange value of the Turkish currency. The currency unit is the piastre, of which there are 100 to the Turkish pound. Par exchange is £T 1.00 to U.S. \$4.40. Exchange has fallen steadily since 1920, however, and in 1930 reached a low point of \$0.47. The Government has been making strenuous efforts to stop the fall. Per capita taxes in Turkey amount to the low figure of approximately \$6.50 a year.

Education and Religion. Between 80% and 85% of the inhabitants of Turkey are illiterate. In 1927, 800,000 or 5.9% of the population, were in Government schools, with considerably more in various

foreign and Turkish private schools. Since then educational facilities have increased. In 1928 the Government ordered that the Latin alphabet should be used instead of the Arabic, and this has made learning much easier. The Government schools cover the entire range from primary through university and special education. The education is strictly secular. Mohammedanism is the religion of the great bulk of the population. The Greeks are Christian, in the main, under the general supervision of the Greek Orthodox Church. From the beginning, the Republic has pushed steadily toward the complete separation of the Church and State, the caliphate being abolished in 1924, and the Constitution being amended in 1928 to eliminate the statement that Mohammedanism was the state religion.

Government. The Nationalist movement against the Ottoman Sultan began in 1920. On Oct. 29, 1923 Turkey was formally declared a republic. Several Constitutions have been adopted. Under the Constitution of Oct. 23, 1927, the sovereignty is declared to rest with the people who act through the Grand National Assembly. The Assembly is made up of deputies elected for four-year terms from the provinces. All males over 21 have the vote. The President is chosen from the members of the Assembly. Women have the right to vote and to be elected in the municipal elections. So far there has been practically only one party, that being dominated by Kemal. The old religious laws have been entirely supplanted by modern codes, copied almost without change from European countries. These provide a system of courts approximately like those elsewhere.

Turkey is divided into 63 vilayets or provinces. These in turn are divided into kazas or countries, which are subdivided into nahiyas. Each of these subdivisions has a separate political entity and considerable local autonomy.

G. C.

TURKEY, HISTORY OF. The area now occupied by Turkey has a history going back to the very beginnings of civilization. Almost from the start, too, and down to the modern times, that history has been a long record of wars and intrigue, of massacre and wanton destruction of property. These events have reduced the Mesopotamian valley, in the early days richly prosperous, to a semi-desert region. Mohammedan influence spread into this general area from Mohammed's own time, and Islam has remained the dominant religion.

Strictly Turkish history began with the establishment of independent authority, at the end of the 13th century, by Osman, son of the leader of a band of Turkish peoples who had been driven down into the Mesopotamian valley by Mongol activities in central Asia. The Seljuk dynasty still was in control when Osman succeeded his father as leader of the nomadic tribe, in 1288. Following the death of the last great Seljuk in 1296, Osman declared his independence, and started the Ottoman Empire along the road which made it, under Suleiman the Magnificent who ruled from 1520-66, one of the principal empires

of the Western world. The Osman or Ottoman dynasty remained in control until the abolition of the Sultanate in 1922. The first 10 rulers, beginning with Osman and ending with Suleiman, steadily extended the boundaries of the empire and developed its importance, partly by wise administration but more by successful conquest. They met with only one serious setback. This was at the hands of Timur, or Tamurlane, who pushed down into Turkey at the end of the 14th century and seemed on the point of destroying the Ottoman Empire entirely. But Timur died and his armies withdrew. When Suleiman the Magnificent died in 1566, the empire reached westward to the Danube, eastward well into what now is Persia, northward to the Black and Caspian seas and southward to include Arabia and Egypt and a large part of the southern shores of the Mediterranean. The conquest of this huge area had been accompanied by repeated and ruthless massacres, and within the empire itself the death of each sultan, as well as the reigns of most, had been marked by numerous executions and bloody revolts. Some of the sultans showed themselves to be men of culture and encouragers of art and learning, notably Suleiman the Magnificent. During the earlier period, the Turks maintained cultural relations with the Eastern Roman Empire through its capital at Constantinople; but this city was captured in 1453 and the last contacts with European learning were broken.

The Sultans who succeeded Suleiman were far below the standard set by their predecessors in vigor or administrative or military ability. Step by step the Ottoman Empire's holdings in Europe were reduced, and efficiency of the administration fell off. The actual dismemberment of the empire began at the end of the 17th century. Then it proceeded rapidly, and the Turkish question became increasingly a cause of dispute among the European Powers. The CRIMEAN WAR of 1854-55 was due primarily to the conflict between Britain and Russia for dominance in Turkey, a conflict which had been developing steadily for half a century and more. In the 19th century, too, the gross mistreatment by the Turks of the Christian populations under their control aroused much indignation in Europe and caused a demand for interference. The Turkish rulers also had involved the country in heavy indebtedness to various European nations by the beginning of the last quarter of that century.

The Balkan troubles which developed in the 20th century, and contributed so much to the creation of the situation out of which the World War grew, arose in large part as a result of quarrels between peoples who formerly had been under Turkish rule.

Decay Under Abdul Hamid. When Abdul Hamid II became Sultan in Sept. 1876, Turkey had degenerated from one of the principal empires of the Western world to "the sick man of Europe," and had become a source of almost constant quarreling between the European Powers. Under Abdul Hamid, who ruled until his deposition in 1909, conditions

steadily became worse. He worked hard, but he was utterly unreliable, mean, cruel and distrustful of everyone. He depended on secret assassinations and an army of spies to maintain the absolute mastery on which he insisted. He announced a Constitutional régime and a National Assembly on Dec. 22, 1876, the day before the scheduled opening of a conference of the Powers to decide what administrative changes should be proposed to the Sultan, and then annulled the Constitution and dismissed the Assembly in May 1877. Russia and Britain in the same year presented a protocol demanding protection of the Christians and, when the Sultan rejected this demand on the ground that it infringed the Paris treaty of 1856, Russia declared war.

By the **TREATY OF SAN STEFANO** which ended this war, Bulgaria, Bosnia and Herzegovina were made autonomous states under nominal Turkish suzerainty, instead of Turkish provinces, Serbia and Montenegro, both much enlarged, and Rumania were recognized as independent. Russia secured Turkish territory in Asia. A conference of the Powers at Berlin (*see* **BERLIN, CONGRESS OF**) in June-July of 1878 revised greatly the provisions of the Treaty of San Stefano, bolstering up the declining Turkish state, weakening Russia's dominant position in the Balkans and leaving material for much future friction. Bulgaria and Serbia went to war in 1886. Turkey and Greece were at war in 1897. In both cases, the Powers intervened. Massacres in Armenia under authorization of Abdul Hamid in 1894-96 violated the guarantee of the Powers in the 1878 Berlin Treaty that the Armenians would be protected. The Turkish administration steadily became more corrupt and inefficient.

A revolution was proclaimed July 23, 1908, headed by the so-called Committee of Union and Progress and with the support of the army. Abdul Hamid submitted, but carried through a counter-revolution on Apr. 13, 1909 which was suppressed by the **YOUNG TURKS**, as the revolutionary group had come to be called. Abdul Hamid was deposed Apr. 24, and his brother was made Sultan. German influence, which had become solidly established through the fact that the German officers had been brought in to train the army, increased, and British influence correspondingly fell.

In 1908 Austria annexed Bosnia and Herzegovina, Crete transferred its allegiance to Greece, and Bulgaria declared its independence. Italy took Tripoli in 1911, a seizure which was confirmed by treaty with Turkey after a year of futile war by the Turks. Meanwhile, the Young Turks failed to carry out the promised reforms, and the Christian populations continued to be the victims of severe oppression. Serbia, Greece, Bulgaria and Montenegro moved, under an informal alliance, against Turkey in the latter part of 1912, nominally to protect the Christians. They all were successful. At a peace conference in London, in the spring of 1913, a treaty was signed by which Turkey gave up all of her European holdings except Constantinople and territory immediately adjacent.

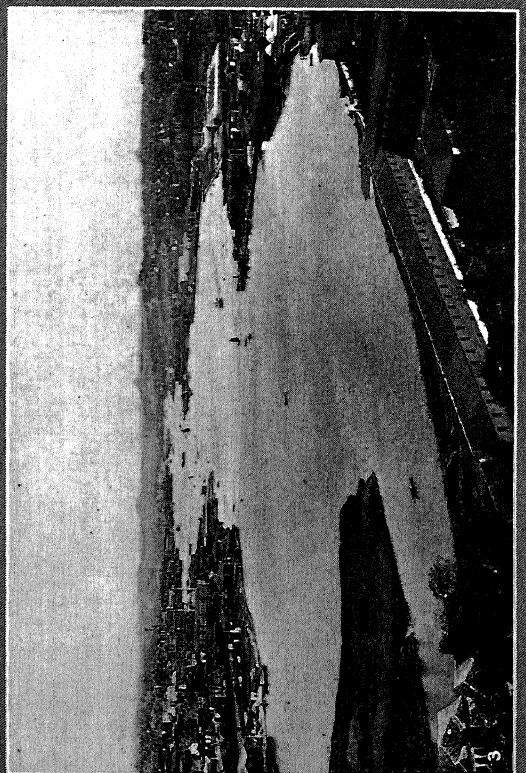
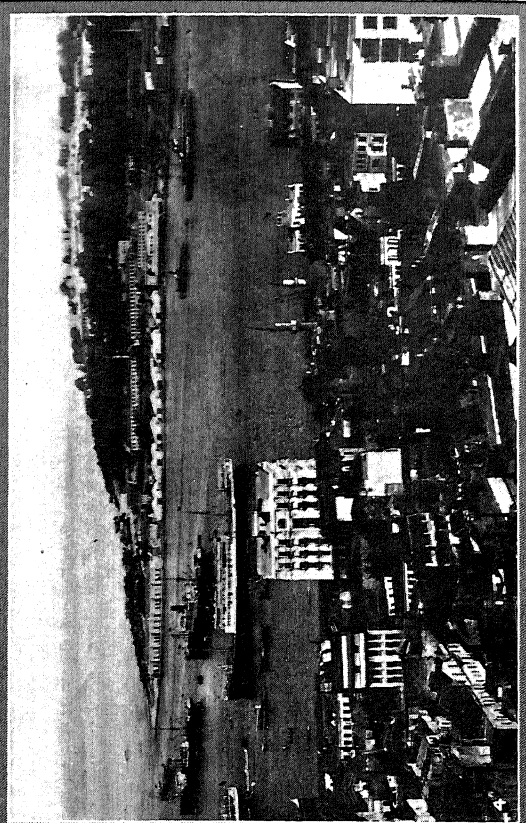
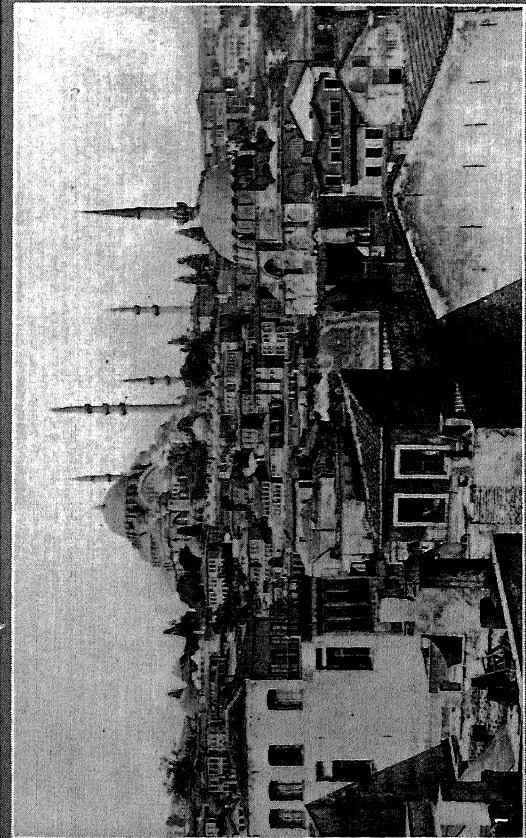
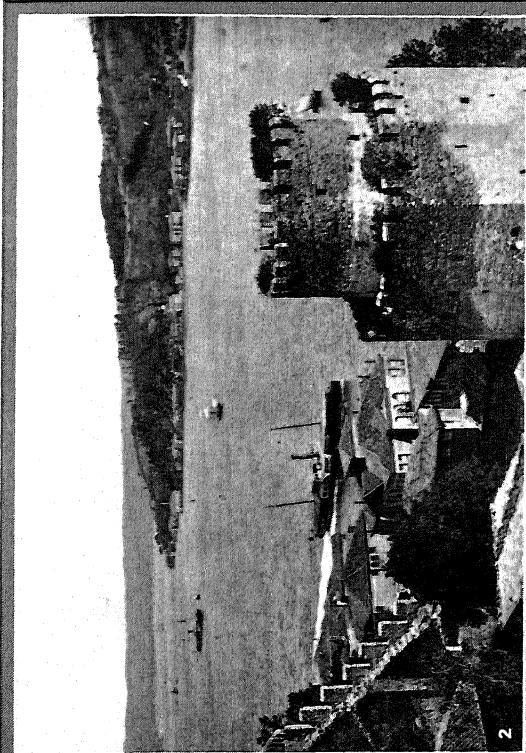
The victors, however, almost at once began quarreling among themselves for the division of the spoils. Turkey joined the fray, and got back Adrianople and part of Thrace.

The World War Period. German influence was dominant in Turkey when the World War began. Turkey at first declared neutrality; but troop mobilization began almost at once. At the end of October fighting had started, with attacks on the Black Sea and toward the Suez Canal. For a time, the small balance of success was with the Turks in the fighting in Mesopotamia in 1916-17, but then the tide turned in favor of the British. Enver Pasha and Talaat Pasha, who had been dominant during the war years and had kept Turkey allied with Germany, fled from Constantinople on Oct. 29, 1918, and the next day Turkish envoys asked for peace. The British commanders, to whom the appeal was made, granted an armistice. Turkey had started the war with 1,000,000 men under arms. She ended it with less than 200,000 possible effectives. According to estimates of the American Relief Committees, one-fourth of the population had died of war, pestilence and famine. The Arab provinces were gone, and the people were starving.

The Allies, busy with other matters, delayed formulating their peace demands on Turkey. The Nationalist movement, headed by **MUSTAPHA KEMAL**, who had been one of the Turkish army officers, gained strength in the interior. When the Allies finally presented their terms, on June 10, 1920, even the Sultan at Constantinople, directly under Allied guns, protested at their severity, and the Nationalists swore resistance to the bitter end. These terms left Turkey only 175,000 square miles of the 613,500 she had had in 1914; took away all of the European holdings except a few square miles in Thrace; ended Turkish rule in Asia except in areas which were entirely or overwhelmingly Turkish in population; gave Smyrna and part of the sea coast to Greek control; put the Dardanelles, the Sea of Marmora and the Bosphorus under Allied control, and provided for the establishment of a virtual financial and economic protectorate over Turkey. The Allies called on the Greeks to put down the Turkish resistance, since they had no armies of their own which they could use. The Greek troops swept over Thrace, and Constantinople signed the **TREATY OF SEVRES** on Aug. 10, 1920, with terms somewhat but only slightly better than the June 10 demands.

Mustapha Kemal and the Nationalists extended their influence. On Jan. 30, 1921, Kemal formally declared that the National Government at Angora was the only lawful one. Following the failure of a conference with the Greeks at London, under Supreme Council auspices, the Greeks attacked in April in spite of Allied warning and disclaimer of responsibility. They were repulsed. Kemal proceeded to conclude a series of treaties with Russia and the Sovietized republics. A convention signed with the French on Oct. 20, 1921 provided for the with-

TURKEY



SCENES IN ANCIENT CONSTANTINOPE, THE MODERN ISTANBUL

1. Mosque of the Sultan Suleiman, built in the 16th century. 2. Part of the capital city lying along the Bosphorus.
3. View of the Golden Horn, the inlet forming a natural harbor. 4. Seraglio Point and the Golden Horn, showing Turkish house-tops.

drawal of French troops. A conference in Paris in Mar. 1922 proposed a three-months armistice between the Greeks and Turks; but both Governments rejected this suggestion. The Greeks, by this time, had become demoralized, both in the field and at home. The Turkish forces attacked in the last week in August, and occupied Smyrna on Sept. 9, driving the Greeks into the sea. On Sept. 23, the Allies sent a joint note to the "Government of the Grand National Assembly" at Angora which was conciliatory in tone and suggested a conference. The Turks agreed, and the Mudania Convention of Oct. 11, 1922 which resulted ended hostilities. Further conferences at Lausanne, beginning Nov. 20, 1922 and continuing, with interruptions, until July 24, 1923, finally resulted in the Lausanne Treaty (*see* LAUSANNE, CONFERENCE AND TREATIES OF) of that date which formally reestablished peace between the Allies and Turkey.

This treaty was essentially in line with the "national pact" formulated by the Nationalist Party in Jan. 1920. The system of capitulations was abolished; Turkey was given control over eastern Thrace and the other areas inhabited by non-Arab Moslems which had been in the Ottoman Empire. The Straits were demilitarized, under a guarantee of security of Turkey given by France, Great Britain, Italy and Japan. The orthodox Greeks in Anatolia were to be exchanged for the Moslems in Macedonia.

Nationalist Reconstruction. The Lausanne Treaty left the Nationalists free to turn their attention to domestic reconstruction. A National Assembly, meeting at Angora in Apr. 1920, had proclaimed a Constitution declaring that sovereignty rested with the nation, and, on Apr. 23, elected Mustapha Kemal head of the Government. The sultanate was formally abolished on Oct. 1, 1922, though the CALIPHATE was continued. Elections, held under a new election law passed in Apr. 1923, gave Kemal's party, which had put forward a sweeping program of civil and economic reforms, an overwhelming majority. The withdrawal of the Allied troops, under the provisions of the Lausanne Treaty, was completed Oct. 2, 1923. On Oct. 12 the new Assembly voted that Angora should be the capital, not Constantinople, and on Oct. 29 Turkey was formally declared a republic. Kemal was reelected President for a four-year term. The caliphate was abolished on Mar. 3, 1924, by vote of the Assembly. A new Constitution was adopted Apr. 20. A civil code, copied from that of Switzerland, was adopted Feb. 17, 1926. New elections were held in Sept. 1927, for which Kemal named all the candidates; of these roughly one-third were new. Kemal was again chosen President for four years. A new Constitution, adopted Oct. 23, 1927, declared that all were equal before the law and that the Church and the State were completely separate. On Apr. 9, 1928 the Assembly voted to cancel the clause in the Constitution saying that Mohammedanism was the religion of the state. A new penal code, borrowed from Germany, came into force Aug. 20, 1929, and a new tariff, definitely protective in character, on Oct.

1. In Mar. 1930 women were given the right to vote and to be elected in municipal elections. On June 1, 1930 the law went into effect prohibiting the use of Arabic characters in all books or writings, the first steps toward the substitution of the Latin for the Arabic letters having been taken in June 1928. In Mar. 1931 the Assembly voted to dissolve and hold new elections. Kemal again named all the candidates of the regular party, planning to replace about one-third of the members. He left 30 seats open for independents; but only 15 were elected to these places at the elections which were held Apr. 24. Kemal was reelected President by the Assembly on May 4, 1931. Ismet Pasha, who had been premier most of the time since the announcement of the republic, again took this office.

These, briefly, are the most significant of the strictly political steps. While these developments were going on, many changes had been made in other directions. The religious orders were abolished; the *medresseh*, or religious schools, were closed; the teaching of religion to children under 14 in any school was prohibited; the system of farming out the tax collections was abolished; the wearing of the fez by officials was prohibited; strict measures were taken to suppress an opposition party which had developed in 1924; but encouragement was given to opposition leaders to develop a group in the Assembly in 1930; railways were built to a total of roughly 1,125 miles or about 45% of the 1920 total. In these and various other ways the reconstruction of the country and the establishment of a modernized régime were pushed forward. Particular care was taken throughout to develop the interest of the people in what was being done, and to explain the reasons for each step.

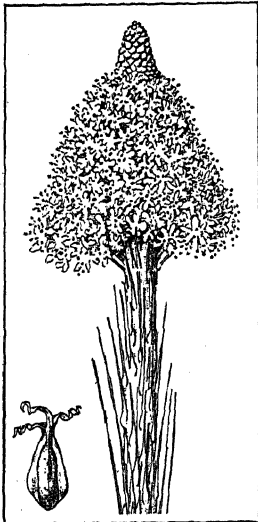
Internationally, Turkey also steadily improved her position. At first there was a decided swing toward association with Russia; but before long feeling turned against the Soviets, and a number of arrests of Communists were made in 1928 and 1929. Treaties of commerce and peace were signed with most of the principal nations. Disagreements with Greece and Persia were straightened out. A working arrangement was made with the Powers for clearing up the pre-war debt of the Ottoman Empire, though because of financial difficulties in 1930 and 1931 the payments under this agreement were not completely met. Strenuous efforts were made to check the steady decline of the Turkish pound in international exchange, though these did not prevent its dropping from a nominal \$4.40 to below .50, after which there was some improvement in 1931. Better and more honest methods of collection of taxes and sharp paring down of expenditures made it possible to secure, for the first time in modern Turkish history, a balanced budget for 1927-28 and to maintain balanced budgets in subsequent years.

All this has not been accomplished without bloodshed. The "exchange of populations" provided for in the Lausanne Treaty left Turkey with comparatively few non-Turkish inhabitants. This homo-

geneity, which held to a greater degree than at any time for many centuries, aided the reconstruction progress; but the progressive secularization of the Government caused a number of minor revolts on the part of extremist Moslems. The Kurds, too, broke out into revolt, on two occasions, against Turkish domination and for Kurdish autonomy. At times methods distinctly terroristic were used to check opposition within Turkey. At no time since 1922, however, has there been any serious threat to the stability of the Kemal régime. G. C.

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TURKEY BEARD, a genus (*Xerophyllum*) of tall perennial herbs of the lily family comprising three species, natives of North America. They are stout plants rising from tuber-like rootstocks with unbranched stems, very leafy below, bearing exceedingly



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WESTERN TURKEY BEARD OR
BEAR GRASS

numerous white flowers in a large, showy, terminal cluster. The eastern turkey beard (*X. asphodeloides*), with a stiff stem 2 to 5 ft. tall, but very narrow leaves and a rather loose flower-cluster 3 to 6 in. long. It grows in dry pine barrens from New Jersey to Florida and westward to Tennessee. The western turkey beard (*X. tenax*), called also bear grass and squaw grass, grows 2 to 6 ft. high with a dense tuft of very narrow basal leaves, 1 to 3 ft. long, and an exceedingly showy flower cluster sometimes 1½ ft. in length. It grows on dry mountain slopes from Yellowstone Park to British Columbia southward

through the Pacific states to southern California. When the plant blooms, usually only after several years preparation, it forms in many mountainous districts a striking feature of the landscape. The tough fibers of the leaves were formerly used by the Indians for making fabrics and baskets; the roasted rootstocks served as a nutritious food.

TURKEY RUN PARK, in Parke Co. in west central Indiana, established in 1916 and containing 1,050 acres. Deep limestone canyons cut by Sugar Creek, 300 acres of primitive woodland, trails and a game preserve are features of the park.

TURKEY VULTURE, called also turkey buzzard, a large American bird (*Cathartes aura septen-*

trionalis) allied to the hawks, eagles and falcons, but differing from them in its weaker bill and blunter claws. It is found widely throughout North America from New York to British Columbia and southward,



G. M. SUTTON. "BIRDS OF PENNSYLVANIA"
J. HORACE MCFARLAND CO. COPYRIGHT

TURKEY VULTURE

wintering in the southern parts of its range. The turkey vulture, which is about 2½ ft. long with a wing spread of about 6 ft., has glossy black plumage with the bright crimson head bare. It flies with extreme grace, soaring in broad spirals on motionless wings, and feeds almost entirely upon carrion, which it espies from great heights. In the southern states, where it is exceedingly common, it renders invaluable service as a scavenger. The turkey vulture builds no nest but deposits its eggs, usually two in number and of a dull white blotched with chocolate, in a hollow stump, among rocks or upon the ground.

TURKISH, an important family of languages of the TURCO-MONGOL-TUNGUS linguistic group spoken by some 40,000,000 individuals in a zone stretching from Thrace in the Balkans to the Yenisei in Siberia. It falls into four dialectic groups: 1. Southern (Turkey, Crimea, Persia, Transcaucasia, Turkmenistan); 2. Central Asian (in the Russian, Chinese and Afghan parts of Turkestan); 3. Tatar-Kirghiz (between the Volga and Tian-Shan, and in western Siberia); and 4. Altai—Upper-Yenisei; besides which, there are two Turcoid languages with numerous traits special to them: Yakut, in the Lena basin, and Chuvash, south of Kazan—probably the language of the ancient Bulgars.

Turkish dialects have very clear characteristics in common, notably that of VOWEL-HARMONY, and their morphology is highly developed, yet amazingly regular. The verb admits of unusual expressiveness: *en-mek*, "come down," *en-dir-mek*, "take down," *en-dir-t-mek*, "make someone take down," etc., and syntax is based on the extensive use of participles, verbal nouns and gerunds, e.g., *ol-dur-ul-duy-unu-*

TURNER



"THE FIGHTING TEMÉRAIRE"

By Joseph Mallord William Turner (1775-1851). In the National Gallery, London.

ishit-di-niz-mi, "have you heard his having-been-killed." The vocabulary is extremely rich in concrete terms, names of colors, onomatopoeias, etc., but very poor in abstract words, which have mostly been borrowed from ARABIC. Osmanli Turkish, the vehicle of practically all the literature of the group, always employed the Arabo-Persian alphabet (which was quite unable to represent the intricacies of the Turkish vowel-system) until 1930 when the use of the Roman alphabet was made compulsory. V. M.

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TURKISH EMPIRE. See OTTOMAN EMPIRE.

TURKMENISTAN or Turkmen S.S.R., one of the seven constituent republics forming the U.S.S.R., situated in central Asia, established in 1925 from territory of the Trans-Caspian region and parts of Bokhara and Khiva. Its area of 173,300 sq. mi. extends to Kazakstan on the north, Persia and Afghanistan on the south, Uzbekistan on the east, and the Caspian Sea on the west. Turkmenistan's highlands are devoted to pasturage. Much of its lowland region is desert or sand dune; rainfall is light, and results in a very dry climate. The generally intense heat is followed by a short but rigorous winter season. The country's sparse population is largely Turkoman, many of whose tribes are nomadic. Uzbeks, Russians, Persians, Kirghiz, Armenians, Tatars and Turks make up the remainder. In various sections the social organization is patriarchal, follows the former Turkish pattern and relegates women to the humblest rôles. A typical Turkoman village consists of clay or felt huts crudely furnished with homemade articles. Cattle, horse breeding and agriculture, based entirely on artificial irrigation, occupy a majority of the inhabitants, and considerable quantities of cotton and wheat are raised for export. Other enterprises include the weaving of carpets, and mining. The richest salt mines in the Soviet Union lie in this region. Sulphur and oil are other natural resources. Illiteracy is widespread. ASHKHABAD, with a population of over 50,000, is the capital and largest city; others are Merv, Leninsk and Kerki. Over 1,200 mi. of railroad and good roads for motor-bus travel link the republic with other parts of Asia. Pop. 1931, 1,137,900.

TURKU or **ABO**, a seaport of Finland and next to Helsinki, the capital, the largest city of the republic. It is situated on the Gulf of Bothnia, near the mouth of the Aurajoki River. Turku is the capital of the province of Turku-Pori. It is the oldest city of Finland, founded more than 700 years ago, and was the capital of the country until 1812. The harbor is approached by four different entrances, every one of which is protected by a modern light-house. The city exports grain, timber and meats. The imports include coal, machinery, salt, oils and cotton. It has a castle of about the year 1300 and a famous cathedral, is the seat of the archbishop, has two universities and other educational institutions. Pop. 1930, 66,234.

TURMERIC (*Curcuma longa*), a perennial plant of the ginger family with tuberous rootstocks yielding turmeric, used as a condiment and dye. The plant, a native of southern Asia, is extensively cultivated in India. From the large rootstocks rise very short stems bearing broad leaves and pale yellow flowers in conspicuous spikes. Turmeric powder, prepared from the old tubers, forms a part of currie powder and is used in chemistry as a test for the presence of alkalies, which change its yellow color to reddish brown.

TURN AND BANK INDICATOR, a combination instrument used on AIRPLANES to measure the rate of turn and indicate proper banking. The turn element consists of a small GYROSCOPE so mounted that it reacts only to motion about a vertical axis, moving a hand in accordance with the rate of turn. The bank indicator is a metal ball enclosed in a curved glass tube in which it is free to roll in response to gravity and to the centrifugal force of the turning of the airplane. It remains in the center of the tube as long as the airplane flies straight and level or when it turns with wings properly banked. C. H. C.

TURNER, JOSEPH MALLORD WILLIAM (1775-1851), English painter, was born in London, Apr. 23, 1775. His early training was as a topographical engraver. This employment took him about the country on sketching trips and imbued him with a deep love of nature. Turner exhibited at the Royal Academy from 1793 on, but it was not until 1820 that he began to show his capacity as a great and original colorist. After Turner's first visit to Italy in 1819 his chromatics increased in richness and were executed in a higher color scale. *The Fighting Téméraire*, in the National Gallery, London, is the most famous of the middle period (1829-39) pictures. The late Venetian canvases are even more splendid in color but the form is weak and the experimental technique has not stood the test of time. Turner's water color technique was as superb as his oil technique was unsound and he is considered one of the world's greatest artists in this medium. After 1845 Turner became sick in mind and body and hid himself in the Chelsea home of a former landlady, where he died on Dec. 19, 1851.

TURNHOUT (French *Thourout*), capital of a district in the Belgian province of Antwerp. It has an old 15th century castle built by Maria of Geldern, which has been converted into a court house. In 1597 Maurice of Orange gained a victory over the Spaniards at Turnhout and in 1789 the Belgian insurgents defeated the Austrians. It produces linen, lace and playing cards, has dyeing, tanning and bleaching plants and carries on trade with Holland. Pop. 1930, 26,792.

TURNIP (*Brassica Rapa*), a biennial plant of the mustard family widely cultivated as a vegetable. During the first season it is a low herb, with long, deeply lobed basal leaves, which produces just below the surface of the ground a globular or flattish, white-fleshed tuber, the turnip of the markets. In the second season the plant sends up a stout stem, about a foot high,

bearing bright yellow flowers and slender pods containing numerous small seeds.

The turnip is a cultigen believed to have been derived from a fleshy-rooted, mustard-like plant originally native to temperate Europe, where its cultivation antedates Greek and Roman times. In cool northern countries, as in Canada and Scandinavia, the turnip is extensively grown as a winter vegetable and also for feeding dairy cattle. In the United States, New England and the Central States lead in production.

TURNSTONE, a genus (*Arenaria*) of small shore birds about 10 in. long, allied to the plovers. They are so-named from their habit of turning over pebbles and shells in search of the various insects, crustaceans and other small animals upon which they feed. The dusky turnstone (*A. interpres*) is very widely distributed throughout the Old World, chiefly on sea coasts. It breeds in the arctic and migrates in winter as far as South Africa and Australia. The closely related ruddy turnstone (*A. i. morinella*), which breeds in arctic America, winters from California and the southern states to Brazil and Chile. The black turnstone (*A. melanocephala*) is found along the Pacific coast from Point Barrow to Lower California.

TURNABLE, a device onto which locomotives, cars, or other vehicles are run for the purpose of turning them through any desired angle in order to permit their transference to another track. It consists essentially of a platform pivoted at the center. *See also* RAILROAD BUILDINGS.

TURNUS, in Virgil's *AENEID*, the son of Daunus and Venilia, and king of the Rutulians. A brave warrior, he fought bitterly against the invading Trojans and at last waged a hand-to-hand combat with *AENEAS*, to whom *LATINUS* had given his daughter *LAVINIA*, previously promised to Turnus. Juno's protection being withdrawn, Turnus was slain in the combat, and with his death *The Aeneid* ends.

TURPENTINE, an oleoresin obtained mainly from incisions in pine trees. It is then distilled to drive off oil of turpentine, is a thin, colorless liquid having a characteristic odor, boiling at about 158° C. It dissolves sulphur, phosphorus, waxes, rubber, resins, etc., will not mix with water, but dissolves in alcohol, ether and glacial acetic acid. Chemically it is a mixture of several hydrocarbons or TERPENES having the formula $C_{10}H_{16}$.

Wood turpentine is produced by steam distilling waste pine wood chips. It has a slightly different and less pleasant odor than gum turpentine, but at present represents a considerable industry (*see* NAVAL STORES). The production of wood turpentine is accompanied by the production of pine oil, which is not the case in the production of gum turpentine.

The main uses of oil of turpentine are as a thinner and flattener in oil paints and varnishes and in the manufacture of synthetic camphor, $C_{10}H_{16}O$. It is used to some extent in medicinal preparations.

E. M. SY.

TURQUOISE, a distinctive, opaque blue mineral which has been popular as a semi-precious stone since

ancient times. The most highly valued color is the sky blue, although greenish gray, green and greenish blue are common. The color often turns to an undesirable green with time. Sunlight and heat cause it to fade, and perspiration has a bad effect on it. As turquoise is porous, it easily becomes dirty. With the exception of some minute triclinic crystals found in Virginia, the mineral occurs only in amorphous forms, as rounded masses, grains, crusts, and in veins. In composition it is a basic phosphate of copper and aluminum. The copper gives it the blue shade, the green colors being due to small amounts of iron.

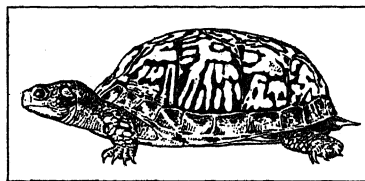
Turquoise matrix is the name given to associated rock containing bits of turquoise. The matrix usually contains LIMONITE, QUARTZ, KAOLIN and FELDSPAR, typical products of rock alteration, as turquoise is deposited from solutions, accompanying the WEATHERING of RHYOLITE, GRANITE and other IGNEOUS ROCKS.

Persia, the Sinai peninsula, Australia, Turkestan and in the United States, New Mexico, Arizona, California and Nevada produce turquoise. *See also* GEM STONES.

TURTLE, a common name for the marine species of an order (*Chelonia*) of reptiles. The term is also given popularly to certain terrapins, fresh-water chelonians, and, in the United States, it is sometimes applied to land tortoises as well.

There is one family (*Cheloniidae*) of hard-shelled true turtles. Its members are large, with their limbs modified to form paddles. Their shells are flattish, and offer less protection to the limbs and head than do those of land tortoises. They live in tropical and sub-tropical seas, and only leave the water to lay their eggs, which they bury in the soft sand.

The prized hawksbill turtle (*Eretmochelys* or *Chelonia imbricata*) has a beautiful horny shell of curved,



BOX-TURTLE

overlapping plates, blackish, brown and yellow in color. This is the "tortoise" shell of commerce. Another very valuable species is the green turtle (*Chelonia mydas*), whose flesh is highly esteemed for steaks and soups. The loggerhead turtle (*Caretta* or *Thalassochelys caretta*) is also edible. Its meat is said to be practically indistinguishable from beefsteak.

One turtle is so different from all other chelonians that some zoologists think it should be assigned to a separate order. This is the giant leather-backed turtle (*Sphargis coriacea*) which may be 8 ft. long and weigh about a ton. Its bony shell is small, and covered by a thick layer of leathery skin, marked with longitudinal ridges.

A. I. W.

TURTLE CREEK, a borough in Allegheny Co., southwestern Pennsylvania, situated near the Monongahela River, 10 mi. southeast of Pittsburgh. It is

served by the Pennsylvania and Bessemer and Lake Erie railroads. The main plant of the Westinghouse Electric and Manufacturing Co. is here. In 1929 retail trade amounted to \$4,337,254. Manufacturing is the chief interest. Pop. 1920, 8,138; 1930, 10,690.

TURTLEHEAD, a small genus (*Chelone*) of handsome perennial herbs of the figwort family with flowers resembling a turtle's head. There are four



P. A. RYDBERG. "FLORA OF PRAIRIES AND PLAINS"

WHITE TURTLEHEAD

species, all natives of North America, two of which are grown as garden ornamentals. They are smooth plants with opposite, toothed leaves and large white or purple flowers borne in short, dense, leafy spikes. The cultivated species include the white turtlehead (*C. glabra*), common in swamps east of the Great Plains, and the purple turtlehead (*C. Lyoni*), of the southern Appalachians. The red turtlehead (*C. obliqua*) occurs in the southeastern states; the western turtlehead (*C. nemorosa*), with violet purple flowers, grows in woods along mountain streams from California to Washington.

TUSCALOOSA, a city of western Alabama and county seat of Tuscaloosa Co., on the Black Warrior River, 55 mi. southwest of Birmingham. The Louisville and Nashville, the Alabama Great Southern and the Mobile and Ohio railroads serve Tuscaloosa which has the University of Alabama (1831), at University P.O. Other institutions include Stillman Presbyterian Theological Seminary (colored; 1876), and the Bryce State Hospital for the Insane and a United States Veterans Hospital. The city's increase in population is due primarily to industries derived from the cotton-growing, lumbering, dairying and mining activities of the surrounding country. In 1929 the manufactures reached approximately \$2,000,000; the retail trade amounted to \$10,957,170. Tusca-Lusa was a Choctaw chief who fought with De Soto in this locality, 1540. The first settlers came from Tennessee, in 1816. Chartered in 1819, the city was the State capital, 1826-46. Pop. 1920, 11,996; 1930, 20,659.

TUSCAN ORDER, the first and simplest of the Roman and Renaissance orders. For a complete description, see **ORDER**.

TUSCANY, a province of Italy, in the southwestern part of the northern half of the peninsula, bounded on the north by Emilia, on the east by the Marcles and Umbria, on the southeast by the compartimento of Rome and on the west by Liguria and the Mediterranean. This area, covering 8,890 sq. mi., is divided into the departments of Arezzo, Firenze, Grosseto, Livorno, Lucca, Massa e Carrara, Pisa, Pistoia and Siena. In general the surface is rolling and well timbered. The most fertile part is the ARNO

valley, in which FLORENCE, chief city of Tuscany, is situated; other important centers are PISA and SIENA.

The principal articles of manufacture are cotton and woolen goods. Glass, porcelain, straw hats and silks are also made. The agricultural products include wheat, maize, oats, beans, potatoes, chestnuts and various other fruits. The region is, however, especially famous for its wine and olive oil. The wine Chianti derives its name from a district in Tuscany. The chief mineral products are copper, iron, marble, coal and mercury. Pop. 1928, 2,886,000.

History. Tuscany was organized as a Marquisate of the Holy Roman Empire after the incorporation of the Lombard kingdom, of which the region had been a part, in the Frankish empire in 774. The line of the counts of Tuscany continued unbroken until 1114 when the Countess Matilda, dying without heirs, willed her dominions to the Church. The Papacy, however, was unable to extend its direct rule in Tuscany, and with the ending of all central government within the Empire, at the fall of the House of Hohenstaufen in the middle of the 13th century, Tuscany disintegrated into a welter of independent city-states.

Of these city republics Florence and Siena soon outstripped all the others and divided the bulk of Tuscany between them, each contesting bitterly with the other for the supremacy over the whole. Florence became the great bulwark of the Guelph, or Papal, cause and Siena of the Ghibelline, or Imperialist. But the imperial cause in Italy was long since lost and the patrician Republic of Florence gradually absorbed all Tuscany. At the same time Florence changed from a medieval Guild-Republic to a duchy ruled by the Medici, and the relative importance of Tuscany sank with the rise of the great dynasties in Spain, Austria and France.

A change of name occurred in 1567 when Cosimo III of Florence was created Grand Duke of Tuscany by Pius V, and a change of dynasty in 1737 when Francis of Lorraine, husband of Maria Theresa, was given Tuscany in exchange for Lorraine. (See **POLISH SUCCESSION, WAR OF**.) On his death in 1765 Francis left Tuscany to his younger son Leopold, who attempted to modernize its archaic government, but being elected Emperor in 1790 left the duchy to his younger son Ferdinand, who ruled until expelled by the French in 1799. Napoleon first organized Tuscany as the Kingdom of Etruria, but in 1807 annexed it directly to the French empire. On the overthrow of Napoleon Tuscany was restored to Ferdinand, who was succeeded in 1824 by his son Leopold II. With the growing movement for a united Italy undermining his authority, Leopold abdicated in 1859 and the duchy was annexed to the Kingdom of Sardinia in 1860, which in 1861 became the Kingdom of Italy.

TUSCARORA, an important confederation of southern Indian tribes speaking dialects of the Iroquoian linguistic stock. When first encountered they were living on the Nuese, Roanoke and Pamlico rivers in eastern North Carolina. Their original atti-

tude toward the whites was peaceful and friendly but due to brutal treatment, which included wholesale appropriation of lands and kidnapping of their youths to be sold into slavery, they finally arose against them in 1711. See TUSCARORA WAR.

TUSCARORA WAR, 1711-13, a conflict between the Tuscarora Indians and the early settlements in North Carolina, occasioned by encroachments upon the Indians' lands. The Tuscaroras mustered about 1,200 warriors; the white population of North Carolina was then not over 7,000. On Sept. 22, 1711 the Tuscaroras made a sudden onslaught upon the settlements along the Roanoke and Pamlico Sound, while allied tribes descended upon other parts of the frontier. On a three-day rampage the Indians killed 130 whites along the Roanoke, 60 at Newbern, and an unknown number at Bath. On the Virginia border the Indians were checked by Virginia troops; responding to Gov. Hyde's call for assistance, Col. John Barnwell led a company of South Carolinians with friendly Indians toward Newbern, and on Jan. 28, 1712, defeated the Tuscaroras with great slaughter. After Barnwell returned to South Carolina the Tuscaroras renewed hostilities. Col. James Moore, heading a body of South Carolinians, marched northward in December, defeated the Indians, pursued them to their last stronghold on the Neuse River, and there, Mar. 23, 1713, killed or took into slavery over 800 Tuscaroras. The remainder of the tribe made peace, moved northward, and was formally admitted into the Iroquois Confederacy.

TUSCULUM, an ancient city of Latium in Italy situated on the Via Latina about 10 mi. southeast of Rome. It was built on the summit of the Colles Tuscullani, with an extensive view over Latium, a circumstance which made it one of the most strongly fortified cities of Italy and one of the favorite summer residences of Roman nobles. The mythological founder of Tusculum was Telegomus, son of Ulysses. The people became Roman citizens in 381 B.C. It was the birthplace of Cato, and Cicero had a villa here. The ancient city was destroyed in 1191. Modern Frascati is just below the site.

TUSKEGEE, a city in southeastern Alabama, the county seat of Macon Co., situated 40 miles east of Montgomery. The Tuskegee Railroad which serves the city connects with the Western Railroad of Alabama. The city is a trade center of a cotton and corn-growing region; the chief local industry is lumbering. Tuskegee is the seat of the TUSKEGEE NORMAL AND INDUSTRIAL INSTITUTE for Negroes, founded in 1880 by Booker T. Washington, and also of the United States Veterans' Bureau Hospital for Negroes. The city was founded in 1833 and incorporated in 1834. Pop. 1920, 2,475; 1930, 3,314.

TUSKEGEE, a small town, formerly inhabited by a group of upper Creek Indians, situated at the fork of the Coosa and Tallapoosa rivers, Elmore co., Ala. In 1799 the town contained 30 buildings and 35 warriors but the group had lost its own language, a dialect of the Muskogean linguistic stock, and spoke

the language of the Creeks whose customs and manners they had also adopted.

TUSKEGEE NORMAL AND INDUSTRIAL INSTITUTE, at Tuskegee, Ala., a non-sectarian, coeducational institution for Negroes, was founded in 1880. Opened in 1881 as Tuskegee State Normal School, the institution received its present title two years later. In 1889 it was endowed by Congress with 25,000 acres of land. Its growth has been rapid and its influence far-reaching. Day and night sessions are maintained, the latter for the benefit of financially handicapped students. Practical training is given in many trade and agricultural occupations, and in nursing, teaching, home-keeping and commercial positions. BOOKER T. WASHINGTON was its principal from its foundation until his death in 1915. The school had an endowment in 1931 of \$7,704,151. Tuskegee possesses 1,850 acres of land. The library contains 20,000 volumes. In 1930-31 there were 2,576 students, and a faculty of 323, headed by Principal ROBERT R. MOTON.

TUSSOCK MOTH, the popular name for any species of the family *Liparidae*. They are so called because the larvæ have tufts of hair on their backs. Larvæ of the commonest species (*Hemerocampa leucostigma*) have red heads, three brushes of long black hair and yellow and black striped bodies. Two red protuberances on the abdomen are supposed to secrete an odor offensive to enemies. They devour foliage on many species of fruit and ornamental trees. When mature they pupate in cocoons attached to trees and other objects. Upon emergence the moths mate and the winged females lay eggs in a frothy mass on their cocoons. Arsenical sprays will kill the caterpillars. Banding with sticky fly paper will keep unfested trees free from them.

TUTANKHAMEN (c. 1365 B.C.-?), Egyptian pharaoh of the 18th dynasty, was a son-in-law of Amenhotep IV (Akhenaten). He ascended the throne of Egypt following the short and uneventful reign of Sakere, who had succeeded Akhenaten upon the latter's death. At first, Tutankhamen, whose name was then Tutankhaten, tried to perpetuate the monotheistic cult of Aten, the Sun Disk, which his remarkable father-in-law had established as the state religion. But he soon realized that Atenism was destined to fail, and under pressure of the powerful priesthood of Amen-Ra, he began to restore the old religion. He transferred his court from the new city of Akhetaten to Thebes, which he restored to its former splendor. Then he substituted Amen for Aten in his own name and that of his wife, Ankhesenpaaten. The worship of the old gods was brought back, and the temples of Amen, mutilated by Akhenaten, were rebuilt, while those dedicated to Aten were disfigured in turn. Except for the ending of Atenism, Tutankhamen's nine-year reign was unimportant. The date and manner of his death are unknown, but he was buried in a magnificent tomb in the Valley of the Kings. This tomb was opened by Lord Carnarvon and Howard Carter in 1922.

TUTELO, an eastern tribe of Siouan stock formerly living on the upper Roanoke and Dan rivers in Virginia and North Carolina. Captain John Smith first mentioned them in 1609. They were hunters but also cultivated the soil. After hereditary warfare with the Iroquois a peace was effected in 1740. The Tutelo moved north and became a part of the Iroquois League through adoption by the Cayuga. Their village near Cayuga Lake was destroyed by Major-General John Sullivan in 1779 and they fled to Canada where they joined the Iroquois on the Grand River Reservation in Ontario. With the possible exception of the few mixed-bloods the Tutelo are now extinct.

TUTOR, literally a guardian or protector; in current usage an instructor or teacher. At Oxford and Cambridge the tutor is the educational and moral supervisor of a number of students. In America the term is applied to any one who prepares students for examinations, or to certain college and university teachers ranking below an instructor. At Harvard the practice of tutoring undergraduates to parallel their courses and lectures has been adopted. Each student has individual conferences with his tutor, as contrasted with the group conferences at Princeton.

TUTUILA, an island of the Pacific Ocean, belonging to the Samoan group and since 1899 a possession of the United States. It has an area of 40 sq. mi. with a mountainous surface and a fertile soil which produces oranges, lemons, alligator pears, limes, mangoes and other tropical fruits. Copra, of an excellent quality, is the chief export. Pagopago is the port of the island. Pop., 1930, 9,768 including the Island of Aunu'u.

TUTUTNI, a group of Athapaskan-speaking Indian tribes, formerly living in villages along the lower Rogue River in Oregon, as well as on the coast to the north and south of its mouth. The survivors of these tribes are now on the Siletz Reservation in Oregon supporting themselves chiefly by fishing, berrying, and fruit gathering for neighboring whites. Formerly they maintained an exogamous gentile organization, practising polygyny.

TUXTLA GUTIERREZ, a city of Mexico and capital of the state of Chiapas, situated on the River Chiapas about 87 mi. from the station of Jalisco at an altitude of 1,776 ft. above sea level. It is an unprogressive, sleepy town with low adobe houses and streets paved with cobblestones. Its industries are tanneries, indigo and tobacco factories, and some trade in cane, coffee, sugar and rubber. It is reached by stagecoach or horseback. Pop. 1930, 15,719.

TVER, a rapidly growing city about 100 mi. north of Moscow, in the Moscow Region of the R.S.F.S.R., on both banks of the Volga and its tributaries, the Tvertsa and the Tmaka. The textile industry predominates, although trade is brisk because of railway links with Moscow and Leningrad. More than one-third of the population works in large factories, which produce cloth, machinery, wagons and leather goods in large quantities. Tver originally belonged to Nov-

gorod, and was several times destroyed in struggles with the Tatars. Its commercial importance began in 1490, after annexation to Muscovy. The Tver Museum is one of the oldest of Russian provincial institutions. Distinctive architecturally are a 16th century monastery and a 17th century cathedral. Pop. 1926, 108,413.

TWACHTMAN, JOHN HENRY (1853-1902), American painter, was born at Cincinnati, O., Aug. 4, 1853. He studied in Cincinnati under Duveneck and in Munich and Paris. He ranks high among American landscape painters. In 1898 Twachtman founded the organization known as the Ten American Painters. His *Waterfall* is in the Metropolitan Museum, New York. Other paintings are *The Hemlock Pool*, *The Torrent* and *Round Hill Road*. The artist died at Gloucester, Mass., Aug. 8, 1902.

TWAIN, MARK. See MARK TWAIN.

TWANA, a North American Indian tribe, a member of the Salishan linguistic stock, comprising three bands, the Colcine, Skokomish and Tulalip. They lived on both banks of Hoods Canal in Washington. The entire group is sometimes called Skokomish. These, numbering in 1931 about 250, live on a reservation in Washington.

TWEED, WILLIAM MARCY (1823-78), American politician, was born in New York City, Apr. 3, 1823. After obtaining a slight education in the public schools, he followed the trade of a chair-maker. He was well-known locally as the foreman of a volunteer fire department engine. Associated himself with the local Democratic organization, he was an alderman 1852-53. He was elected as a Democrat to the national House of Representatives in 1852, serving from 1853-55. He was defeated as a candidate for reelection in 1854. He held, thereafter, a number of local offices, member of the Board of Supervisors for New York Co., 1858, deputy street commissioner, 1861-70, and a State Senator, 1868-72. In 1870, he became the Commissioner of the Department of Public Works. He was foremost in the organizing of the notorious "Tweed ring," which utilized the political strength of TAMMANY HALL to maintain itself in power, and then used this power to defraud the city. The *New York Times* in 1871 published a list of alleged frauds of the "Tweed ring," whereby the city by means of corrupt contracts for public buildings and street railways had been robbed of an estimated sum which ranged from \$45,000,000 to \$200,000,000. He was tried in 1874 for official embezzlement, found guilty, and sentenced to a fine and 12 years' imprisonment. He escaped in December, 1875, to Spain, where he was captured, and brought back to New York City by a U.S. war vessel. He died in the Ludlow Street Jail, New York City, Apr. 12, 1878.

TWEED, important river of southern Scotland. Rising at Hart Falls in the Southern Uplands of Peebles Co., it winds east, first through a large flat plain and then through beautiful country characterized by softly rounded hills covered with dense verdure for a total distance of 95 mi. into the North Sea at

Berwick. It drains a total area of 1,870 sq. mi. Its last miles form the border between Scotland and England, celebrated in poetry and romance. The "silver Tweed" is joined by the Ale Water, Yarrow Water, the River Teviot and other affluents as it flows past famous abbey sites, Melrose, Kelso and Dryburgh. The stream is not navigable, but along its banks are cloth mills for the manufacture of tweeds and other woolen fabrics.

TWELFTH NIGHT "or What You Will," a merry, care-free comedy by SHAKESPEARE; produced about 1602. It is chiefly based on a story in *Barnabe Riche his Farewell to Military Profession*, 1581. The duke of a certain seaport town of Illyria is madly in love with Lady Olivia. It so happens that Viola and her twin brother, Sebastian, who have been shipwrecked, arrive in this town, each ignorant of the other's presence, and that Viola, dressed as a boy and calling herself "Cesario," becomes a page to the lovesick Duke Orsino going in his name to court the Lady Olivia who perversely falls in love with the page. At Olivia's house there is a comic interlude carried on by Sir Toby Belch, Sir Andrew Aguecheek, Maria (a servant), and Malvolio, the majestic major-domo of the household, who is led by Maria into believing himself madly loved by his lady and thus into some highly ridiculous situations. In the end, after a rarely amusing duel between "Cesario" and Sir Andrew, Viola and Sebastian are identified, and Olivia marries Sebastian and the duke makes Viola his bride.

TWELVE TABLES, the first code of the Roman law. These tables were drawn up in 451 and 450 B.C. according to tradition and were the basis of the Roman law until its further codification by Justinian in 528 A.D. They provided for cases concerning such matters as civil process, settlement of debts, the patria potestas, guardianship and inheritance, and the public and sacred law.

TWENTY-ONE DEMANDS, the agreements between China and Japan signed May 25, 1915. Japan had seized the German holdings in Shantung shortly after the outbreak of the World War. She desired to strengthen her position in Manchuria, to secure permanent hold of the former German interests in Shantung and to obtain mining and railway rights in central China. On Jan. 18, 1915, the Japanese minister to China presented to President Yuan Shikai a series of demands, in four groups covering these points, with a fifth group of what were called "desires." The presentation of the demands was made in the face of strong opposition from civilian leaders in Japan and a strenuous attempt was made by the Japanese to keep secret the fact that such demands had been presented and that negotiations were in progress. The negotiations continued, with some revision of the demands, until May 7, when Japan presented an ultimatum allowing China 27 hours to sign. China agreed the next day, and on May 25 the various documents were signed. These did not include the fifth group, of "desires," which Japan said she would hold in abeyance for further discussion

later. At the Washington Conference the Japanese delegates announced, Feb. 2, 1922, that Japan formally dropped group five of the 1915 demands.

The 21 demand agreements which were signed provided in group one for the extension of the Japanese leasehold in the Liaotung Peninsula and of Japan's holding of the South Manchuria Railway to 99 years, and for the opening of Manchuria to Japanese settlement. These provisions still stand, though China has refused to give effect to that permitting the leasing of land by Japanese. China also agreed in group two to accept any arrangement made between Japan and Germany for the disposition of the latter's Shantung holdings after the World War. These provisions were in effect cancelled when Japan agreed, at the Washington Conference, to return the former German holdings to China. By the 1915 agreements Japan also secured certain railway construction rights in Shantung, which she has not exercised and which have practically been cancelled. The notes covering the third group of demands confirmed Japanese predominance in the management of the Hanyehping coal and iron interests in the central Yangtze region. Continued disturbance in this area in recent years caused the suspension for a time of the operation of these interests, and the Chinese have in effect regained control, though technically the Japanese hold remains. The notes covering the fourth group simply pledged China not to alienate any part of her coast, except on her own initiative. No such alienation is likely. Group five, the "desires," provided for the appointment of Japanese advisers in important posts in the Chinese government, a development which, if carried out, would in effect have given Japan control of the government. This group of demands was not covered by notes which were signed, and it was dropped later. The only part of the 1915 agreements still remaining in effect, therefore, are those relating to Japanese interests in Manchuria.

Japan's action in 1915 stirred up a storm of protest in China, and aroused considerable criticism in Japan. The Chinese have taken the position that the agreements signed were invalid because China's acceptance was secured under threat of force, and because the agreements not only never have been ratified by any legislative body in China but also have been specifically repudiated by Kuomintang congresses. The Japanese contend that the agreements are valid because they were signed by the president of China, Yuan Shih-kai, whose signature was binding since no parliament then was in existence in China.

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TWILIGHT, originally the interval between sunset and the completion of night, now often used to indicate the time during which there is some illumina-

tion on the earth and in the atmosphere either before sunrise or after sunset. Two kinds of twilight are now recognized: civil twilight, ending or beginning when the sun is 6° below the horizon, and astronomical twilight, ending or beginning when the sun is 18° below the horizon.

In the tropics, where the sun may at times rise and set perpendicularly, civil and astronomical twilight may last no longer than half an hour, or an hour and a quarter, respectively. Where the sun sets very obliquely, as in higher latitudes, the consequent duration of twilight becomes increasingly longer. In a latitude of 49° the sun cannot descend to more than 18° below the horizon on the longest day of the year; hence on that date there is no astronomical night, properly speaking. In still higher latitudes the number of such days further increases, until at latitudes higher than $66\frac{1}{2}^{\circ}$ it is possible for the sun itself not to disappear below the horizon during a whole day or more; it is then visible as the MIDNIGHT SUN.

The yellow, red and orange colors of twilight are due to indirect illumination of the atmosphere by the sun which is really below the horizon. Dust particles and water vapor play an important part in it.

TWIN FALLS, two cataracts in Yoho Valley, part of Yoho National Park, British Columbia. These falls which occur on two separate mountain streams, plunge side by side over a projecting ledge, 400 ft. into an abyss which leads to Yoho River. They have their greatest volume in the summer since they are fed by glaciers and melting snow. Yoho Valley into which they fall is part of the majestic mountain wilderness of the Canadian Rockies. It is hemmed in by lofty peaks encrusted with glaciers from which many streams issue into the valley. Besides Twin Falls there are here several other cataracts of striking beauty, principally Takakkaw and Laughing Falls.

TWIN FALLS, a city in southern Idaho, the county seat of Twin Falls Co., situated on Snake River, 147 mi. southeast of Boise. It is served by bus lines and the Oregon Short Line of the Union Pacific Railroad. There is an airport. This irrigated region has diversified agriculture. The city has a fruit dehydrating establishment, flour mills, warehouses, a number of farmers' co-operative associations and other business and industrial interests. North of the city is the Black Lava Canyon of Snake River, spanned by a bridge 476 ft. high. The city was named for the falls on either side of a great lava deposit in the river. Twin Falls was founded in 1905 and incorporated the same year. Pop. 1920, 8,324; 1930, 8,787.

TWIN FLOWER (*Linnaea borealis*), a creeping evergreen herb of the honeysuckle family sometimes called ground vine and deer vine. It is found in rocky woods widely throughout the cooler parts of the north temperate zone. The slender, sometimes slightly woody stems bear oval, opposite leaves and nodding pink flowers produced in pairs at the branched summit of the threadlike, erect flower-stalks. This delicate plant, one of the most beautiful of

woodland flowers, was a favorite of the great Swedish botanist Linnæus in whose honor it was named by Gronovius. By some authorities the North American forms of the twin flower are regarded as a distinct species (*L. americana*).

TWINKLING of the stars, the fluctuation in the light and color of the stars, due to irregularities in the atmosphere of the earth.

TWISTING, the textile manufacturing operation by which two or more yarns are twisted about each other to form one heavier yarn. Twisting machines resemble spinning machines, except that they are not equipped for drafting.

TWIST MODULUS. See ELASTICITY.

TWO GENTLEMEN OF VERONA, an early comedy by SHAKESPEARE, written about 1595, of which the chief source is the story of Felismena in Montemayor's *Diana Enamorada*. Valentine of Verona leaves his native city and, arriving at Milan, begins his courtship of Silvia, daughter of the duke. He is soon followed by the fickle Proteus, his friend and the unfaithful lover of Julia. Disguised as a boy, Julia in turn follows Proteus. Valentine, on the eve of eloping with Silvia, is betrayed to the duke by Proteus and, quitting Milan, becomes the captain of a band of outlaws. At length the four lovers are brought together in the forest where Valentine holds his outlaw court, and, after numerous incidents and explanations, Proteus marries Julia and Valentine marries Silvia. Perhaps the most amusing character in the whole play is Proteus's servant, Launce.

TWO NOBLE KINSMEN, a drama which is thought to have been written in collaboration by SHAKESPEARE and JOHN FLETCHER; first produced in 1625. Borrowed from *The Knight's Tale* in Chaucer, this is the drama of two imprisoned friends, Palamon and Arcite, who fall simultaneously in love with Emilia, daughter of Hippolyta. At Theseus's command the two lovers agree to settle the issue of their love in a trial by combat, the outcome of which is that Arcite, though victorious, dies of a fall from his horse and leaves Emilia to Palamon. There is an incidental drama of the mad love of the Jailer's daughter for Palamon.

TWO RIVERS, a lake port city in Manitowoc Co., eastern Wisconsin, situated on Lake Michigan, at the mouth of the Shoto and Mishicot rivers, 85 mi. north of Milwaukee. Bus lines, lake steamers and the Chicago and North Western Railroad serve the city. Farm crops are raised in the vicinity. The chief local manufactures include aluminum ware, percolators and drafting-room, printers' and dentists' equipment. The retail trade in 1929 amounted to \$5,080,936. Two Rivers was founded in 1837 and incorporated in 1878. Senator Thomas J. Walsh was born here. Pop. 1920, 7,305; 1930, 10,083.

TYLER, JOHN (1790-1862), tenth President of the United States, was born at Greenway, Charles City Co., Va., on Mar. 29, 1790. His father was Gov. John Tyler of Virginia (1808-11), and his mother was Mary Armistead Tyler. On both sides

the family ancestry was English, and the son was reared in the Episcopalian faith. After attending the local school, where at the age of 11 his independence discomfited the despotic Scotch master, Tyler entered the elementary division of the College of William and Mary. He was graduated in 1807, and began studying law at his father's suggestion.

He was admitted to the Virginia bar in 1809. The elder Tyler's prominence in political affairs at this stage led the son to seek public office, and in 1811 he was elected to the Virginia state legislature, where his vigorous support of Madison's policy toward England won respect for the 21-year-old legislator. When war was declared the following year, Tyler raised a field company to aid in the defense of Richmond. He continued to serve in the Virginia assembly until November 1816, when he was chosen to fill a vacancy in the national House of Representatives. In this body he remained up to 1821, and made his influence felt as an unswerving Jeffersonian Democrat. Tyler was opposed to Calhoun's bill for internal improvements, and fought unceasingly against such measures as Clay's proposal to recognize the independence of the rebellious Spanish-American colonies, the federal bankruptcy law, the MISSOURI COMPROMISE legislation, and tariff increases. His strenuous work in the House caused his illness, and in 1821 Tyler was forced to decline reelection to the lower house. Two years later he returned to political life when he was again elected to the Virginia legislature. During 1825-27 he was governor of Virginia, and in his last year of gubernatorial office was elected to the United States Senate as successor to John Randolph. In the upper house Tyler preserved his independence from party rules, remaining a strict "constructionist," unalterably opposed to any protective tariff. While a member of the Senate, he was a delegate to the Virginia Constitutional Convention. The outstanding events during Tyler's senatorship, which he resigned in 1836, was his condemnation of the South Carolina ordinance of nullification, his denunciation of Jackson's proposal to coerce the state, and his political identification with the Whigs when Jackson proposed to withdraw government funds from the United States Bank. In the election of 1836 he first appeared as a Democratic Presidential possibility. The "States-Rights-Whigs" nominated him for the Vice-Presidency, and Tyler received 47 votes. He was without public office for two years, entering the Virginia legislature a third time in 1838. The following year he made an unsuccessful bid for the Senate, and a few months later was nominated by the Whigs for Vice-President, running with W. H. Harrison. The Whig candidates obtained 234 electoral votes, and were accordingly elected. Gen. Harrison died one month after the inauguration, and Tyler began his Presidential term in 1841.

Tyler retained Harrison's cabinet until its members, excepting Daniel Webster, opposed his veto of a measure to reestablish a national bank, which the

President believed was unconstitutional in the absence of the sanction of the states. His conflict with cabinet and Congress placed him in the anomalous position of a President without political or Congressional support. The Whigs repudiated him for his veto of the federal bank bill, and Van Buren refused to admit him a Democrat. In the difficult negotiations with England, Tyler was fortunate in retaining until 1842 the services of Webster, who negotiated the WEBSTER-ASHBURTON TREATY. In 1842 the President declined to send federal troops to quiet the DORR REBELLION in Rhode Island. As the end of his term approached, the annexation of Texas was considered by scattered Democrats as a victory on which Tyler might be reelected, and in May 1844 he was nominated at an irregular party convention. The following August he withdrew from the race, certain that Polk would defeat him.

Thenceforth Tyler held no public office until his election in 1861 to the Congress of the Confederate States. He attempted the rôle of peacemaker when South Carolina seceded in 1860, and was president of the Peace Convention, which assembled in Washington early in 1861.

On Mar. 20, 1813, Tyler married Letitia Christian. After her death early in his Presidential term, he married Julia Gardiner. Their son, L. G. Tyler, is a well-known educator. Tyler died of a bronchial attack at Richmond, Va., on Jan. 18, 1862, and was buried at Hollywood in the Confederate capitol.

TYLER, ROYALL (1757-1826), American jurist and author, was born in Boston, Mass., July 18, 1757. He was graduated in 1776 at Harvard and studied law under John Adams. In 1790 he settled in Vermont, becoming a judge of the supreme court in 1794 and serving as chief justice in 1800-06. In 1809 he published *Reports of Cases in the Supreme Court of Vermont*, but his reputation as a writer was made by his plays, *The Contrast*, *May Day* and *The Georgia Spec*, and by his verse and works of fiction including *Moral Tales for American Youths* and *The Yankee in London*. He died at Brattleboro, Vt., Aug. 16, 1826.

TYLER, WAT (WALTER) (?-1381), English rebel and leader of the Peasants' Revolt of 1381. He was an artisan, his surname indicating that he was a roofer. The unrest of the time was due in large part to the onerous taxes levied upon England for the carrying on of the French Wars. But it goes back also to fundamental social changes which were aggravated by the BLACK DEATH and the STATUTE OF LABORERS. Peasants and artisans joined hands in these uprisings, which at first had considerable success. Wat Tyler led his followers to London where they were joined by the London apprentices and artisans. But during a conference with the young Richard II, in which the king appeared to grant his demands, Wat Tyler was killed by the mayor of London on June 15, 1381, and the revolt was speedily suppressed.

TYLER, a city and the county seat of Smith Co., northeastern Texas, situated 105 mi. east of Dallas.

Airplanes, bus lines and two railroads serve the city. Cotton, corn and vegetables are the chief crops of the vicinity. Dairy cattle also are raised. Discovery of oil in the district in 1929 has made the city an oil trade market. It is also an industrial center, manufacturing clothing, bricks, dairy products and fertilizers. In 1929 the value of the factory output was about \$3,000,000; the retail trade amounted to \$11,589,324. The city was founded and incorporated in 1846. It has a junior college. Pop. 1920, 12,085; 1930, 17,113.

TYLER DAVIDSON FOUNTAIN, a noted ornamental monument in Cincinnati, Ohio, erected on the esplanade of Fountain Square, Fifth Street. It was presented to the city in 1871 by Henry Probasco to commemorate his brother-in-law. The fountain was cast at the Royal Foundry in Munich, and by its various sculptures represents the manifold uses of water. It extends 38 ft. above the esplanade and has a basin and heavy base of dark porphyry.

TYLOR, SIR EDWARD BURNETT (1830-1917), English anthropologist, was born at London, Oct. 2, 1830. In 1856 with Henry Christy, an ethnologist, he visited Mexico and in 1861 published his observations in *Mexico and the Mexicans, Ancient and Modern*. Four years later he established his reputation as a student of human origins by the publication of *Researches into the Early History of Mankind*, but his fame rests chiefly on *Primitive Culture*, published in 1871, in which he elaborated the theory of animism. Tylor was appointed keeper of the university museum at Oxford in 1883 and in 1896 became first professor of anthropology at Oxford. In 1909 he retired to Wellington, Somerset, where he died Jan. 2, 1917.

TYNDALE, WILLIAM (c. 1492-1536), English reformer and translator of the Bible, was born in Gloucestershire, England, about 1492. He received his education at Oxford and Cambridge and early in life became a disciple of the new learning which Erasmus taught at Cambridge. Fearing interference with translation of the Scriptures from the original Hebrew and Greek, he fled to the continent in 1524, where after visiting Luther at Wittenberg, he settled in Cologne. From this city he was later expelled and went to Worms where in 1526, he published his octavo translation of the New Testament. Because he attacked the proposed divorce proceedings of Henry VIII, that monarch demanded his arrest; and in 1535 he was betrayed and imprisoned in the Castle of Vilvorde near Brussels. A long heresy trial ensued but the year following he was strangled and his body burned. His translation of the Bible is important as the first from the original languages and the foundation of all future translations. He died Oct. 6, 1536.

TYNDALL, JOHN (1820-93), British scientist, born in County Carlow, Ireland, Aug. 2, 1820. From 1839 to 1847, he was engaged in various activities, serving in the ordinance department, on surveys and as an engineer. In 1847, he became professor of mathematics and surveying in Queenwood College.

He received a doctorate from Marburg in 1851. Tyndall was made a fellow of the Royal Society, and, in 1854, he became professor of natural philosophy in the Royal Institution. He succeeded Faraday as scientific adviser to Trinity House and the board of trade in 1866. The next year he became superintendent of the Royal Institution. He and Huxley studied the glaciers of the Alps. Tyndall is the author of numerous works on his investigations but is best known as a popularizer and teacher of science. In 1872-73, he made a lecture tour in the United States. He died at Hindhead, Dec. 4, 1893.

TYNDALL, MOUNT, a peak in the high Sierra Nevada region of Tulare Co., California. It is not far from Mt. Whitney and is the beginning of the east range peaks of the Kern River canyon. The summit with an elevation of 14,025 ft. was first reached by Clarence King and Richard Cotter, members of the Whitney Geological Survey, in July 1864, when it was named for the great English physicist. There are 11 peaks in the state with loftier summits.

TYNEMOUTH, a municipal and county borough of Northumberland, England, including the townships of Chirton, Cullercoats, North Shields, Preston and Tynemouth, lying about 270 mi. northwest of London on the river Tyne. Though a Roman settlement, its history actually begins with a 7th century monastery which, raided at least three times by the Danes, was totally destroyed. The present ruins are of an 11th century monastery of which the Norman and Early English church is particularly notable. Fragments of the Norman castle built as a defense against marauding Danes and finally destroyed by the Scots in 1640, are incorporated in modern barracks. As the Brighton of the north modern Tynemouth is a favored resort for Newcastle people and offers many places of amusement. Pop 1921, 63,770; 1931, 64,913.

TYNE RIVER, formed by the union of the North and South Tyne rivers in Northumberland, England. It flows 35 mi., serving as a boundary between Durham and Northumberland for the last 18 mi., and enters the North Sea at Shields Harbor. There are several important factory towns on the Tyne, including Newcastle, Newburn and North Shields. The river is much used for shipping.

TYPE, in taxonomy, the specimen upon which the original description of a species was based; or the species upon which the original description of a genus was based. A type specimen is the specimen which determines the application of a species name; a type species is the species which determines the application of a genus name. Also in higher groups, the order is typified by the type family; the family by the type genus. When a genus or species is divided the generic or specific name is applied to that portion of the original genus or species which includes the type species or the type specimen. In modern descriptions the type is indicated by the author but in the older descriptions the type must be inferred as none is indicated. Type, as above defined, is some-

times called the nomenclatural type to distinguish it from a biological type which is a representative of the group to which it belongs. A. S. H.

TYPE, PRINTING. Sizes of type are measured by body depth, or thickness of line. The printing face is almost invariably smaller. Practical text composition sizes range from $5\frac{1}{2}$ point (*see* POINT SYSTEM) (14 lines to the inch) to 14 point (not quite five lines to the inch). Display sizes range upward to 72 point (one inch), and even 120 point. From 6 to 14 point, a two-point interval separates the most commonly used sizes. From 12 to 48 point, the interval is 6 points, and 12 points thereafter.

For very large sizes wood is often used instead of metal to minimize weight and expense. Characters are mechanically carved on the end of the grain of hard maple blocks, dressed to type height. The unit of measure is the 12-point line, and sizes are designated appropriately; as, 10-line, 50-line.

Type styles or faces are available in great variety. In about 1450 all type was of the text or black-letter design, similar to German. Before the end of that century both Roman and Italic faces had been designed. In the next century Caslon designed the classic Roman that bears his name, and less than 125 years after the invention of typography Bodoni designed the first modern letter. Practically all styles are derived from these, and from the forms used in the earlier manuscript books.

Classified as text or straight matter composition types, there are but two important groups of faces: oldstyle and modern. The distinguishing characteristics are greater variation in light and heavy strokes of the characters in modern as compared with oldstyle, square serifs in modern as against rounded serifs in oldstyle, and other differences less pronounced. All other faces are grouped together. In practice, each font consists of five alphabets of the same body size and like characteristics; viz., Roman capitals, small capitals, lower case, italic capitals and lower case.

E. W. P.

TYPE CASES, shallow wooden drawers with many compartments in which printing type is kept. In the days of hand-set books and newspapers a font of type was kept in a pair of cases. The upper case on the stand contained the capitals, small capitals, leaders, dashes, fractions, reference marks and other special characters. The lower case contained the small letters, figures, punctuation marks and spacing units. Job fonts are usually smaller, and omit most of the special characters, so that a single case for the entire font may be used. Capitals occupy the right-hand third of the case, while the left two-thirds duplicates the arrangement of the news lower case, with narrower boxes. The California case is the favorite of several types of job cases. In type cases, capitals follow alphabetic arrangement closely, while lower case characters are arranged for convenience, the most-used characters being nearest to the operator. E. W. P.

TYPE CASTING MACHINES, machines for making printer's types. The first type casting machine

to prove successful was invented by David Bruce, Jr., in 1838. It combined a pot for melting the type metal, a piston which operated in the pot to force metal into the mould and matrix, and a mould which automatically closed and opened to receive its charge and eject the type. This machine produced type which had to be trimmed by hand. In 1888, Henry Barth invented a machine which both cast and finished the type. The Barth machine produces small type at the rate of about 200 per minute. A rotary type casting machine has been developed in England which turns out type at the rate of 1000 per minute. There is also a type punch-cutting machine which operates on the principle of the pantograph, producing letters of any size from one pattern. The **LINOTYPE** and **MONOTYPE** are also typesetting machines, but they compose the type, in addition to casting it. *See also* TYPE, PRINTING.

TYPE FOUNDING, the process of casting printers' types. Until 1835, when the first **TYPE CASTING MACHINE** was invented, it was entirely a hand process. Now types are founded by hand casters, steam casters or automatic casters. Most important in the process is the making of the matrix. A matrix is produced by striking a steel punch or die in a bar of copper, by the electrotype method, or by an automatic matrix-cutting machine. The completed matrix is fitted into a mold and molten **TYPE METAL** is poured into it. The metal hardens in the shape exactly imposed by the matrix, producing the desired type. *See also* PRINTING; TYPE, PRINTING.

TYPE METAL, the alloy used in typesetting. It usually consists of about three-fourths lead, with approximately equal parts of tin and antimony, other ingredients in insignificant amount making up the balance. Lead is used because of its low melting point and easy workability. Tin imparts hardness and toughness. Antimony is used for its peculiar characteristic of expansion when cooling. Sufficient antimony is used to balance the contraction coefficient of the other metals, producing a cast undistorted by shrinking. Small amounts of copper, brass or zinc may be added to impart durability and to raise the melting point. *See also* TYPE CASTING MACHINES.

TYPE SETTING, the assembling of type characters to form words, lines, sentences and paragraphs. The assembled line rarely fills the measure exactly, and must be made to do so by replacing the blank spaces between words with wider ones until the line is filled. Sometimes by thinner spacing a few more letters may be added to complete a word or syllable at the end of the line. This process is called justification.

Knowledge of the niceties of typographical style, spelling, punctuation, capitalization and word division are essential to the successful typesetter. The display compositor, in the absence of a lay-out, should be able to exercise artistic judgment in his selection of type faces, in securing balance, harmony and correct proportion in his design, and in the tasteful allotment of white space.

Hand Composition, is the manual arrangement of lines, paragraphs and columns of type for PRINTING. Seldom does any man profess to be proficient in every field of composition. The book man is skilled in manipulating the product of the composing machines into pages; in arranging front and final matter hand-set portions; in setting tables, formulae and captions for cuts and runs around cuts impossible for machines. Text matter for books is usually set on machines, though occasionally an unusual book is heralded as hand-set. Niceties of spacing are possible in hand composition that are usually lacking in machine work, but the principal value is in publicity potentialities. IMPOSITION calls for intimate knowledge of the arrangement of pages for printing.

News make-up men must be capable of accurately and rapidly assembling pages from the typesetting machine product, hand-setting heads when necessary and inserting cuts, all under editorial direction. Countless requirements of style and practice must be observed.

Ad and job lay-out men design display units and lay out specifications for the composition of the patron's copy. Composers assemble cuts, type, borders and machine-set matter according to specifications; in the absence of a lay-out man, they create and execute their own plans.

Highly-skilled and dexterous hand workers are required in every division of the work, who are often specialized to the exclusion of other operations.

Machine Composition, is the setting of type and the "justification" of the various lines of type for printing by machine. Modern printing machines cast their type new, the practice being to melt it for recasting, when it has served its purpose. The first successful machine was the LINOTYPE, which casts a type-faced slug. Slug-line composition is unrivalled for speed and economy, as the product can be handled most expeditiously in the make-up of columns and pages.

The earliest slug-casting machines carried a single magazine, equipped with matrices for but one font of type. These, however, could be drawn out, and another run in. Soon the two-letter matrix was developed, doubling the possibilities of the machine. Then came the multiple and auxiliary magazine features, affording the operator a choice of 15 to 20 alphabets without leaving his seat. In view of the many improvements, it is possible to equip a modern machine to supply practically every composition need of a newspaper, except illustrations.

While the slug machine has developed a wide versatility, yet straight matter composition is its forte. Newspapers employ it almost exclusively, and it has come to be quite widely used in book and magazine work, because of the availability of a wide variety of the best type faces.

Single type composition by machine has been so perfected that its product is practically equal to foundry cast type. The MONOTYPE system presents possibilities entirely unique. Not only is its product available on the POINT SYSTEM in sizes from four to 18

point, but each character cast is a multiple of a "set" or letter width unit which can be altered within certain limits. Another important feature of single type composition is that any fraction of the line may be justified. This feature is admirably adapted to tabular work. Multiple justification at predetermined points permits opening the type mass for the insertion of perpendicular rules.

Type matter of this class is corrected from sorts stored in cases without involving the machine or interrupting its production. Other kinds of machine composition must go back to the machines for correction. Monotype case sorts may also be used for original hand composition. Moreover, the machine is equipped to cast sorts in sizes above its composition range.

The photo-composing machine, a recent German invention, is controlled by a keyboard mechanism which causes the photographic exposure of the character desired. Words and lines are thus composed upon a sensitized film which is made up into columns and pages and developed as a printing plate by a photo-engraving process. Such a method is equally adaptable to relief, offset or intaglio plate processes.

E. W. P.

TYPEWRITER, a machine for writing in characters corresponding to those produced by printing. It comprises, essentially, type for the various characters, a mechanism for striking or pressing the type against the paper, an ink impregnated ribbon and a carriage for holding the paper and carrying it to the left as the writing proceeds. In all typewriters the type is operated by depressing keys, and in the common typewriter it is mounted on bars and strikes the paper with a percussion action. In one type of a noiseless machine the characters are formed by pressure on the type instead of by percussion. In one make the units are mounted on a section of cylinders that are interchangeable.

PRODUCTION OF TYPEWRITERS, U.S.

Item	1929	1927
No. of establishments	28	26
No. of wage earners ..	16,910	15,603
Total wages	\$22,352,443	\$19,397,911
Cost of mat., fuel & elec. curr. ..	7,265,248	9,936,080
Total value of products	66,039,468	55,318,864
Value of new typewriters	54,443,357	50,386,757
Standard models, incl. long carriage	31,368,939	31,770,405
Portable & bookkeeping models ..	23,074,418	18,616,352
Value of rebuilt typewriters	2,549,418	1,555,162
Value added by manufacture:—		
Total	58,774,220	45,382,784
Per wage earner	3,476	2,909

To meet the requirements of special work, such as that of the chemist, typewriters having special type are used. To meet the needs of particular working conditions various designs of machines as the portable, the electric and the automatic have come into use. Portable typewriters are small, compact and light enough to be easily carried. The electric machines

are designed for speedy and easy writing, the typebars being operated by electric power at a slight depression of the keys. For duplicating work the automatic typewriter has been developed. It is operated by electricity and is controlled by a perforated paper roll resembling that used on a player piano. Combinations of the typewriter and calculating machines are utilized in office work such as posting in bookkeeping, and in making out invoices. These machines are known as bookkeeping and billing machines respectively. One of the most interesting developments of the typewriter is the telegraphic typewriter. This machine is used in telegraph and newspaper offices for automatically typewriting the message on paper as it comes in over the wire.

TYPHOID FEVER, an acute general infection caused by the growth within the body of large numbers of a specific bacterium, *Bacillus typhosus*. The fever, diarrhea or constipation, and rash, which characterize the disease are the result of the reaction of the body to poisons produced by this organism.

The disease is practically always contracted by taking into the mouth substances which have been infected by direct or indirect contact with the excreta of patients harboring the bacteria. About ten days after the initial infection, the patient becomes gradually conscious of general malaise, headache and abdominal pain, which may be accompanied by diarrhea or constipation, or by nosebleed. During the first week his temperature mounts daily, dropping considerably each morning, until it reaches 103°F. The abdomen is tender, the pulse is relatively slow (about 100), the spleen enlarges, and the typical rash appears. The latter is in the form of rose-red spots, flat, slightly raised, generally appearing first on the abdomen, also covering the trunk or extremities. During this period the organisms are multiplying, especially in the intestine where they cause irritation of its lining and swelling of certain patches of lymphoid tissue in its walls (Peyer's patches).

During the second week the face becomes dull and pale, but the fever continues unabated. The patient is likely to become delirious. These symptoms continue into the third week, weakness and loss of flesh becoming marked. The Peyer's patches form ulcers which may discharge large quantities of blood into the intestine, or perforate into the abdominal cavity. Either of these conditions is severe, as the loss of blood may be too great for the resisting powers of the debilitated patient, and perforation causes a peritonitis which is likely to be fatal. Furthermore, the disease may be complicated by pneumonia, small clots in the blood stream, wild delirium, or involvement of the heart, kidney, or bones in the infection.

If, however, the patient escape complications, the temperature gradually falls during the fourth and fifth week, the appetite returns, strength is regained, and the weight approaches normal. Signs of a severe course or a fatal termination are seen in a general aggravation of symptoms, restlessness, delirium, and feeble, rapid pulse. Approximately 15% of patients die.

However, typhoid fever may be prevented by isolation of cases and carriers (*see* CARRIERS OF DISEASE), and disinfection of their excreta and objects which have come in contact with them. It is necessary also to prevent epidemics by insuring of a pure water supply, milk supply, and immunizing of persons likely to be exposed. This last operation is performed by the injection of a quantity of dead typhoid bacteria under the skin. Immunity thus induced continues for several years.

The number of epidemics has been enormously reduced of late years by changing the source of water of certain cities, and by legislation. Typhoid fever is especially likely to develop in armies under conditions of war, and formerly killed more soldiers than did bullets. In the Spanish-American war 1,580 soldiers died of typhoid, while in the war of 1914-1918 but 162 American soldiers died of the disease, though the strength of the army was approximately ten times as great.

The course of the disease depends greatly upon the care of the patient. Milk and sugar are the most important items in the diet, and plenty of water should be administered. Tepid or cool sponges and baths help to reduce the temperature. Other treatment is largely symptomatic.

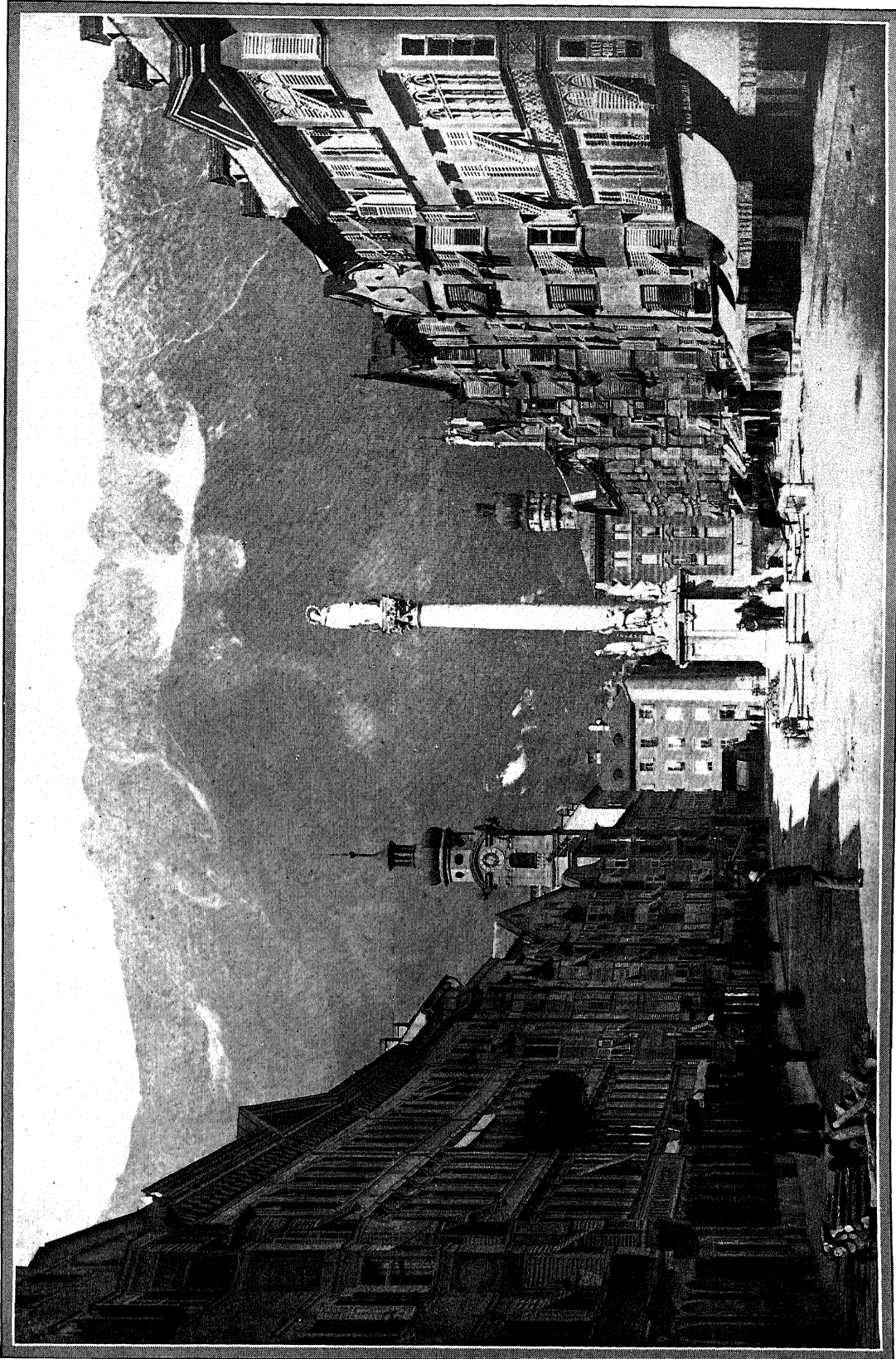
For its resemblance to trichinosis, *see* TRICHINOSIS.
W. J. S. K.

TYPHOON, the name given to the cyclonic storms of great violence occurring in the China Sea, entirely similar in strength to those called hurricanes elsewhere. Like that of the hurricane, their strength on the Beaufort scale is indicated by the largest number, 12. While the wind velocity may reach 100 miles per hour or more, they are generally not more than 100 miles in diameter and occur mostly in autumn. The origin of the name is probably Chinese or Hindustani.

TYPHUS FEVER, a self-limited, acute infectious disease, caused by the presence of minute bacteria-like *Rickettsia* bodies similar to those causing ROCKY MOUNTAIN SPOTTED FEVER, and transmitted by the body louse during feeding. The disease is rare under modern sanitary conditions of living, but may occur in great epidemics, where large numbers of persons are associated together in uncleanly, unhygienic conditions, as in ships, prisons, labor camps, and in military life under war conditions.

Approximately twelve days after infection the patient has a sudden chill, accompanied by deep pains, headache, nausea, and restlessness, soon passing into prostration. The temperature rapidly rises, with slight morning remissions, and remains about 103°F. after the fifth day. At that time a red rash appears which covers the body, except the head; and the patient becomes markedly restless or wildly delirious. After about five days of excitement, nervous prostration naturally ensues. He may pass into a stupor or become unconscious. In favorable cases the temperature drops suddenly and recovery follows without danger of a relapse. From 10 to 20% of cases die following

TYROL



COURTESY CONSULATE GENERAL OF AUSTRIA

INNSBRUCK IN THE TYROL

Maria-Theresina Street, the chief thoroughfare of Innsbruck, with the columned statue of Saint Anna, commemorating the evacuation of the Tyrol by the Bavarians, July 26, 1703.

an unfavorable crisis. A microscopic examination of the tissues of persons who have succumbed to the disease shows that the chief injury is to the walls of the small arteries, causing loss of blood into the tissues and reduction of vitality of the tissues which they supply, especially in the brain.

There is no specific treatment for typhus fever. Progress in combatting the disease must be made in enforcing of proper living conditions, isolation of patients, and delousing of possibly infected garments by heat. Its symptoms closely resemble those of typhoid fever, from which it has been distinguished only during the last century. *See also* TROPICAL MEDICINE. W. J. S. K.

TYPOGRAPHY. *See* PRINTING.

TYR or **TYRR**, in Scandinavian mythology the god of war and son of ODIN. He lost his right hand in a struggle with Fenrir, the wolf. Tyr killed Garm, the dog at the Gnipa cave, but at the same time received a wound from which he died. Tuesday is named for him. He was one of the chief AEsir gods.

TYRANT. *See* DESPOT.

TYRAS, a river forming the boundary line between Dacia and European Sarmatia, now the Dniester. At its mouth was a town by the same name, probably a Greek colony from Miletus. This town is now known as Ackerman.

TYRE, an ancient town of Syria and seaport of the Phoenicians, was built on an island and partly on the mainland, now a peninsula. It was colonized from Sidon probably before the 14th century B.C. Although sacked by Alexander in 332 B.C. and passing under the Seleucids in 198 B.C. and to Rome in 68 B.C., Tyre was a city of importance up to the Middle Ages. The Moslems took it in the 7th century. In 1124 Tyre fell before the Crusaders who retained it for over 150 years, but it was finally destroyed by the Moslems in 1291. The modern Sur is on the site.

TYROL or **TIROL**, the western province of the republic of Austria, with an area of 4,882 sq. mi., lying between Bavaria on the north and Italy on the south, and between the Austrian provinces of Vorarlberg and Salzburg. Pop. 1923, 313,885. INNSBRUCK is the capital.

In magnificence of scenery Tyrol rivals Switzerland, of which it is a continuation. The Alps enter it from Switzerland in three chains, of which the central, the Tyrol or Oetzthaler Alps, is the loftiest (11,000 to 12,000 ft.), and divides the country into north and south. The drainage of the north is mainly carried to the Danube by the Inn, which is the only navigable river; that of the south is conveyed to the Adriatic by the Adige. About one-third of the surface is practically inaccessible, another third is occupied by forests. There is some mining for lead near Landeck, at the entrance to the Engadine of Switzerland, and for iron and salt in the extreme northeast, where Hallein is one of the most important salt-working centers in Austria. But the main occupations are pastoral, with a typical Alpine dairy industry. The people

are highlanders, famous for marksmanship and for music—including the training of singing birds. X.

Tyrol was conquered by the Romans, 14 B.C. and held by them for 500 years until the time of the Teutonic invasions, when the Ostrogoths, and later the Bavarians, overran the northern portion and the Lombards the southern. The fact that the former quickly Germanized the district in which they settled, while the latter became Romanized, has given rise to much ethnographic and political controversy.

The entire region was subdued by the Franks and became a part of the Empire of Charlemagne, only to be broken up somewhat later into the feudal holdings of partially dependent counts. In 1004 the southernmost of these, the Trentino, was given by the Emperor Henry II to the Bishop of Trent, who in 1027 also acquired Bozan and Vintschgau from Conrad II. The temporal rights over this territory were held by the Bishop until 1803, when they passed to Austria, and in 1814 the territory was formally annexed.

Meanwhile most of the German Tyrol had been given by Conrad II to the Bishop of Brixen, whose power was gradually supplanted by that of the counts of the Adige or of the Tyrol. The last of this family was Margaret Maultasch, from whom the Tyrol passed to Duke Rudolph IV of Austria in 1363. Under the HOUSE OF HABSBURG the people became freedom loving and patriotic. When Napoleon gave the Tyrol to Bavaria by the Treaty of Pressburg in 1805 a peasant uprising led by Andreas Hofer was strong enough to defeat larger forces time after time but was finally crushed. Hofer was then shot by the express orders of Napoleon. By the TREATY OF PARIS in 1814, the Tyrol was restored to Austria.

The position of Italy in the World War was much affected by her old claim to the Italian speaking Trentino which went back prior to 1848. Before she entered the struggle, she negotiated with Austria who promised her the province but refused to do more. On the other hand, the Allied Powers, in the Treaty of London, May 1915, guaranteed to her the Brenner frontier and territory on the Adriatic and thus brought her into the war on their side. The Tyrol was promptly invaded by the Italians, and the Trentino became the scene of heavy fighting, much of it at a high altitude, where the Austrians held the more advantageous positions and often under conditions of heavy storm or severe cold. Roads had to be built up steep mountain sides and heavy guns dragged to the heights. Desperate attacks and counterattacks gained and lost positions until the final forward movement of the Italians, supported by British and French forces, took Trento, Nov. 3, 1918.

The Treaty of St. Germain gave Italy not only the Italian speaking Trentino, but also the Upper Adige with a population of 213,000, Germans in race and speech. Against these the Fascisti have been carrying on a vigorous policy of Italianization that has aroused a spirit of intense resentment among the liberty loving Tyrolese. Since the provisions of the

Minorities Treaties were not signed, however, by Italy, the guaranties secured to minorities in other countries do not legally apply in the Tyrol.

A. L. L.

TYRONE, an industrial borough of Blair Co., central Pennsylvania, situated on the Little Juniata River, 15 mi. northeast of Altoona. It is served by bus lines and the Altoona and Logan Valley and the Pennsylvania railroads. There is an airport. The district has highly productive modern farms, raising chiefly wheat and corn. Tyrone is a shipping point for coal mined in the vicinity, and has paper mills and chemical works. Near by are large tracts of timber under State control. Tyrone was laid out about 1851 and incorporated in 1857. Pop. 1920, 9,084; 1930, 9,042.

TZE HSI (1835-1908), Chinese empress widely known as the Empress Dowager. She belonged to a Manchu family of some distinction, and was born in Peking. When 16 years old she was selected as a concubine of the fifth rank for the Emperor Hsien Feng. Virtually uneducated at the time, she devoted

herself to study and in due course became known as a fine scholar in the Chinese tradition. In 1856 she bore a son. Upon the death of Hsien Feng in 1861, she was able to have her infant son named as the emperor (Tung Chih, who ruled 1861-75), and to secure complete control of affairs in her capacity of Empress Dowager. She maintained this control until her death in 1908 except for a short interval in 1898. An exceptionally able woman herself, she had the ability to choose and work with able counsellors, the most noted being Li Hung-chang and, later, Li's protegee YUAN SHIH-KAI. She was strongly conservative, but after the experiences of the Boxer Uprising had taught her that China must prepare to take a place in the modern world, she encouraged modernization, opening the way in education and taking steps toward the establishment of constitutional government. She died in 1908. Tze Hsi, frequently referred to as the "Old Buddha," is both bitterly condemned and highly praised in China—condemned for her unscrupulousness and utter selfishness; praised for her extraordinary ability.

U

UAMASI, a North American Indian tribe of the Muskogean linguistic stock, important in the early history of South Carolina. Their aboriginal habitat seems to have been the coast and islands of southern Georgia and Florida. They were under the jurisdiction of a Spanish mission as early as 1570, but revolted in 1687 and fled to the English colony in South Carolina. They settled in several villages, at first siding with the English in their conflicts with the Tuscarora, but later revolted against the English and carried out a massacre. They afterward returned to Florida where they remained under the protection of the Spaniards. Their settlement at St. Augustine was destroyed by the English, so that by the end of the 18th century the entire group was practically annihilated, though some were said to have been enslaved by the Seminole among whom a small group is said to have maintained its identity until early in the 19th century.

U-BOAT. See SUBMARINES.

UCHEAN, a North American Indian linguistic stock confined to a single tribe, the YUCHI.

UDALL, NICHOLAS (1506-1556), English dramatist and religious writer, was born in Hampshire in 1506, and took his B.A. degree at Corpus Christi, 1524. In 1535 he was graduated M.A. Oxford, and became Master of Eton the same year, but was dismissed in 1541 for immorality and was imprisoned. He won royal favor for his part translation of Erasmus's *Paraphrase of the New Testament*, and was given a prebend in Windsor, 1551, and the parsonage of Calborne, 1553. Under Edward VI he engaged in theological writing. When Mary ascended the throne she bore him no ill-will for his Protestantism and employed him to write dialogues and interludes. It is not known how long Udall thus served the queen, but in 1555 he was Master of Westminster School. His *Ralph Roister Doister*, licensed in 1556, the first English comedy of everyday life, was probably written for his scholars at Eton or Westminster. He died Dec. 1556, and was buried at St. Margaret's, Westminster.

UDINE, a city of northeastern Italy, capital of the province of the same name in Venetia, situated on the Roggia Canal and several railroads. It has a Romanesque cathedral with a hexagonal campanile, the archiepiscopal palace with fine frescoes by Giovanni da Udine and Tiepolo, a citadel on an eminence, a 15th century city hall rebuilt in 1876, a clock tower, a theater and several private palaces. It is the seat of a prefect and an archbishop, and has a seminary, technical schools and a municipal museum with a library. The chief manufactures are machines and textiles, and there is trade in grain and hemp. First mentioned as *Udene* in 983, the city was

then a possession of the Patriarch of Aquileia. In the 15th century it fell into the hands of the Venetians. In 1848 Udine took part in the revolt against Austria, and became Italian in 1866. In the World War it was the Italian headquarters from 1915-17, and was occupied by the Germans, Oct. 29, 1917. Pop. 1931, 66,488.

UFA, capital of the Bashkir Autonomous Soviet Socialist Republic. It is situated southwest of the Ural Region, a part of the R.S.F.S.R., near the point where the Ufa and Belaya rivers join. Its importance as a trading center is consequent upon its situation between the fine agricultural country and the rich timber and mineral lands of the Urals. Ufa was the first Russian town in the Bashkir country, founded as a fort in 1596; it has been an administrative center only since 1922. Copper smelting works, sawmills, flour mills, rope works and brandy distilleries are outstanding enterprises. The foremost institutions are the Central and State museums of art. Pop. 1926, 98,537.

UFFIZI GALLERY (*galleria degli Uffizi*), a museum of art in the Uffizi Palace at Florence, Italy. This famous gallery of painting and sculpture, one of the most extensive and valuable in the world, contains the *Venus de Medici*, the *Wrestlers*, *Niobe*, *Boy Drawing Out a Thorn* and other ancient sculptures; and paintings by Raphael, Michelangelo, Titian, Correggio and other great masters. The palace originally housed part of the art collection of the Medicis. This collection, given to the state in 1737, forms the nucleus of the present collection. Arranged chronologically by schools, it shows the development of Italian painting from the 14th to the 16th century. There is also a collection of tapestries of great historic importance. The Pitti Palace, which contains another great art collection, is connected with the Uffizi by a passageway.

UGANDA, a British protectorate in east Africa, bounded on the north by Anglo-Egyptian Sudan, south by Tanganyika and Lake Victoria, east by a line drawn from Mount Zulia on the Sudan boundary to the eastern shores of Lake Victoria, and on the west by Belgian Congo. Area 94,204 sq. mi. The natives include Negro and Hamitic tribes, but more than half are Bantus. The protectorate is a plateau in character. Although the prevailing vegetation cover is of the park-land type, there are large sections of forest containing mahogany, plantain and bamboo. The natives are good cultivators and for a long time have raised high-grade cotton, of which the amount has steadily increased in recent years so that now about 600,000 acres are grown. This product provides nearly 90% of the export values. Native cotton cultivators have been greatly encouraged by the government, and are not placed in competition with white planters, who

occupy themselves chiefly in coffee production. Sugar cane is grown along the northern shores of Lake Victoria. The natives grow bananas, peanuts, maize and upland rice.

Lakes George and Albert have some effect in modifying the temperature of Uganda. There are large portions of marshy country round Lake Victoria and Lake Kioga, and here the ground is being cleared and planted with lemon grass to offset danger of disease from the tsetse fly. In some of the swampy districts of the protectorate sleeping sickness is a terrible scourge, though not so prevalent as formerly. The League of Nations Commission for research into tropical diseases, with headquarters at Entebbe on Lake Victoria, has completely stamped out the disease in the surrounding area.

Kampala is the commercial center of Uganda, and has a short railroad connection with Port Bell. Entebbe is the administrative center. Uganda was first visited by British explorers in 1860. Several mission stations were established, but under the native kings Christians were persecuted and a bishop was put to death. In 1894 a British protectorate was declared over the native kingdom which was from then on administered by a governor and commander-in-chief. The native chiefs are supported and encouraged in the management of their own subjects. There are several schools conducted by missionary societies, and the government recently established a university at Kampala for the higher education of the natives. Est. pop. 1929, 3,410,857, including 3,396,323 natives, 12,539 Asiatics and 1,995 Europeans, the latter living on the higher lands.

UHLAND, JOHANN LUDWIG (1787-1862), German romantic poet, was born at Tübingen, Apr. 26, 1787. He studied law at the University of Tübingen, practiced his profession for a time at Stuttgart, and in 1829 was appointed Professor of German Literature at the University of Tübingen. In 1848 he became a member of the Frankfurt parliament. Uhland made some scholarly contributions to the study of myth and folk-song, but is best known as a poet. Perhaps the most famous of his ballads are *Taillefer*, *The Minstrel's Curse* and the *Luck of Edenhall*. Two unimportant dramas complete his works. Uhland died at Tübingen, Nov. 13, 1862.

UHRICHSVILLE, a city in Tuscarawas Co., eastern Ohio, situated on Stillwater Creek, about 40 mi. south of Canton. Two railroads afford transportation. There are coal mines in this region. The city has large sewer pipe factories and various clay products plants. Northeast is Schoenbrun, the site of the first settlement in Ohio. Uhrichsville was founded in 1803; incorporated in 1832. Pop. 1920, 6,428; 1930, 6,437.

UINTAH, a division of the Ute Indians belonging to the Shoshonean linguistic stock. This group formerly lived in northeastern Utah and probably included the so-called Elk Mountain Ute. The name was subsequently applied to various bands assembled at the Uintah Reservation in Utah.

UJPEST or **NEW-PEST**, an industrial section north of Budapest, Hungary. With large docks, it is a station for Danube steamers and is a railroad center. Music and industrial schools are located here, and manufactures include cotton goods, chemicals, perfume, clothing, furniture, leather, glue, electro-technical supplies and footwear. Ujpest is also a summer resort. Pop. 1930, 67,374.

UKRAINE, or Ukrainian S.S.R., one of the seven constituent republics forming the U.S.S.R., in southwestern European Russia, extending for 174,000 sq. mi. from White Russia, the Western and Central Black Soil Regions of the R.S.F.S.R. on the north, the North Caucasian Region on the east, Crimea and the Black Sea on the south, and Rumania and Poland on the west. Within its borders lies the Moldavian Autonomous Republic. Rich, black-earth plains, steppes in the south and forests characterize the Ukraine; the forest lands are marked by deep ravines. The mighty Dnieper River flows through a plateau, passing the celebrated Dnieper Falls, above which the greatest hydroelectric plant in Europe is being constructed. Shoals are frequent along the banks of the generally sluggish rivers, notable among which are the Bug, Dniester and Donetz. Moderate temperature and rainfall have led to the development of agriculture; the Ukraine is 80% rural, and among its products grain and sugar are heavily exported, constituting an important part of the Soviet Union's wealth. Fruits, vegetables and tobacco are abundant, and cattle breeding is an outstanding item in the agricultural economy.

The republic's extensive mineral resources include salt, phosphorus and kaolin. Here are mined 80% of the coal in the Soviet Union, 95% of the manganese, and 70% of the iron.

In industrial enterprise the Ukraine ranks first in the production of steel, sugar, agricultural machinery, flour and chemicals, while 8,500 mi. of railway and 1,782 mi. of navigable waterways provide facilities for export trade and internal commerce. Commerce and industry thrive in the big cities, of which there are a number. Kiev, the third largest city in the Union, has a population of over 500,000; other metropolitan centers are KHARKOV, the capital, ODESSA, Dnepropetrovsk, Stalin, Nikolaev and Poltava. Many new towns are springing up in the Donetz Basin. Ukrainians compose 80% of the population. Great Russians make up 9.2% and Jews 5.4%; Poles and Germans are other large groups. The distinctive Ukrainian culture and language are being revived under the Soviets. Education is far from general, but is improving constantly, and universities of the first rank are numerous. It is one of the oldest of the Soviet republics; set up in 1917, it was definitely organized in 1919. Pop. 1931, 31,403,200.

History. The early history of the country is that of Russia, with Kiev as the capital, a period that lasted until the Tatar domination from which Moscow emerged as leader. The word Ukraine became applied to the territory when it was part of the Polish Lithuanian Empire, which exercised a control largely

nominal over the freedom loving Cossacks of the Dnieper. In 1667 the land east of that river was ceded to Russia, and by the partition of Poland Catherine II gained the remainder of the Ukraine except Galicia.

About the middle of the 19th century a Ukrainophil movement began that was both cultural and political in its ideals. When the Russian Empire fell in 1917, the Ukrainians proclaimed their autonomy and set up the Ukrainian People's Republic, which was recognized by the Bolsheviks. The following year serious trouble developed. The Government of the Ukraine fell under the suspicion of the Bolsheviks because of its treaty with the Central Powers and the presence of German and Austrian troops. After the collapse of the Central Powers in November, Gen. Petliura seized control and set up a dictatorship. This lasted until Feb. 1919, when a Bolshevik uprising drove Petliura from Kiev and restored the Soviet republic. As this fell during Denikin's victories still a third Ukrainian Soviet Republic was proclaimed, 1920. The independence of the country was recognized by both Poland and Russia in the Treaty of Riga, Oct. 12, 1920 and Mar. 18, 1920, and on Dec. 28, 1920 a treaty was signed that defined the relations between Russia and the Ukraine. On July 6, 1923, however, the Ukraine became a constituent part of the UNION OF SOCIALIST SOVIET REPUBLICS. It includes the autonomous Moldavian Socialist Soviet Republic formed in Sept. 1924.

UKRAINIAN or **RUTHENIAN, LITTLE RUSSIAN**, an East SLAVIC language spoken by about 32,000,000 people in the Ukrainian Soviet Republic and other parts of the U.S.S.R., by 4,000,000 in Poland, by 470,000 in Czechoslovakia, and by 500,000 in Rumania. It is most closely akin to **RUSSIAN**, from which it differs, e.g., in having *i* and *h* instead of *o* and *g*. It has been developed as a literary language only very recently with the strong support of the Soviet government.

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UKRAINIAN S. S. R. See **UKRAINE**.

ULCER, an open sore which has a tendency to persist or enlarge. An ulcer may involve any free surface, whether it be in contact with the exterior, as the skin; or within a cavity, as nose, or intestine.

Ulcers have their origin either in injury, in reduced vitality, in bacterial growth, or in a tumor whose cells are rapidly destroyed. The course of the lesion varies with the nature of its causative agent. If a clean ulcer becomes infected, or if a mixed infection occurs in one already infected, the resulting condition tends to be more severe.

During the stage of extension, the surface is covered with a gray or yellow slough, there may be considerable discharge, and the margins are raised and red. The condition resembles a superficial **INFLAMMATION** attended by considerable destruction of tissue. An extending ulcer should be induced to heal by removal of the cause, stimulation of the formation of granula-

tion tissue, rest, warmth, and application of mild antiseptics. In refractory cases it may be necessary to scrape the surface or to apply a skin graft.

When healing commences, the superficial slough becomes lost, the discharge is reduced, a thin film of exudate forms over the surface, and granulation tissue forms. This new tissue consists of minute elevations, each containing a bright red capillary loop. Later, the margin forms new skin, which gradually closes together. If the lesion has been deep, considerable scar tissue is likely to form. During the healing stage the important point in treatment is protection.

Ulcers induced by **CANCER**, **SYPHILIS**, or **TUBERCULOSIS** are best treated by measures directed toward those diseases. See also **GASTRIC ULCER**; **DYSPEPSIA**.

ULEMA or **ULAMA**, learned men of Islam. There are various orders and localities of them so that the interpretation of the Canon Law may be properly provided for. At their head is the **MUFTI** or Shaikhu'l-Islam of Constantinople. Their lower ranks are recruited from the poorer classes; but their upper ranks usually represent some degree of learning and culture. They may be deemed the representatives of the people as off-setting to a degree the autocracy of rulers.

ULFILAS (c. 311-c. 380), bishop and translator of the Bible into Gothic, was born of Christian parents in Cappadocia about 311. At the synod of Antioch, 341, he was consecrated bishop of the Arian Visigoths. He preached in Greek, Latin and Gothic, and is noted for his Gothic translation of the Greek version of the Bible. In this work, he and his assistants invented a written alphabet which made use of both Greek and Gothic forms. Only the Gospels, fragments of the Epistles and a portion of the Old Testament exist to-day. The principal MS., the *Codex Argenteus*, is in the library of the University of Upsala, which with the fragments at Milan, Turin and Wolfenbüttel, Germany, comprises the most ancient literary monument of the Germanic tongue. He died at Constantinople in 380 or 381.

ULIANOVSK, formerly Simbirsk, administrative center of Ulianovsk district in the Middle Volga Region of the R.S.F.S.R. The city derives its name from the foremost of its natives, **LENIN** whose real name was Ulianov. A bridge for the railway which travels west to Ufa crosses the Volga here. A fort arose on this site in 1648 near Muscovy's eastern frontier; from this town the rebel Cossack leader, Stepan Razin, led his revolt in 1670. The Cathedral of the Ascension is the finest church and the Book Palace located here is the district's greatest library. In Ulianovsk the textile industry is well developed and considerable river commerce goes on, as the city is a transfer point for goods from steamer to railway. Pop. 1926, 72,274.

ULIXES. See **ULYSSES**.

ULL or **ULLR**, in Scandinavian mythology the son of Sith and Orvandel, and the hero who, when Odin fled from **ASGARD**, was chosen to rule the Vanagods. Previously he had gone with Svipdag to rescue **FREY** and **FREYIA** from the giants.

ULM, a German city in Württemberg about 50 mi. southeast of Stuttgart. In the narrow and crooked streets are interesting buildings, among them the rathaus, an imposing building of the 15th century, with the famous Market Fountain in front, the former house of the Teutonic Order, the Kornhaus, the leaning Butcher Tower, and **ULM CATHEDRAL**. Ulm produces motor buses, machines, brass wares, agricultural implements, hats, accordions, cement, tobacco and clocks for towers. The trade is chiefly in lumber, leather and seeds. A royal estate and residence in Carolingian times, it became the capital of the Duchy of Swabia. Destroyed in 1134 by Henry the Proud of Bavaria, it was rebuilt and flourished, becoming a free imperial city with considerable territory. Ulm fell to Württemberg in the first decade of the 19th century. Pop. 1925, 59,357.

ULM CATHEDRAL, a church in the Gothic style in Ulm, Germany, begun in 1377. The building, 404 ft. long, with an area of 54,839 sq. ft., is built mainly of brick and the tower in the center of the west façade, completed between 1880-90, is of stone. It rises 528 ft. and is the highest church tower in Europe. There are four aisles in the nave divided by slender pillars and no transepts. The cathedral is noted for its triple tower-porch, decorated with reliefs and fine statues, the originals of which and some valuable panel paintings are now in the Neithart Chapel in the church. There is handsome gilded carving on the altar and the choir stalls by Jorg Syrlin, the Elder, are famous examples of 15th century art. The stained glass, particularly that by Hans Wild, is very beautiful. Many tourists ascend the tower to the square portion, a distance of 230 ft. and obtain a fine view of the city.

ULRICH VON LICHTENSTEIN (c. 1200-c. 1275), Middle High German minnesinger, was born in Styria, about 1200. As Landeshauptmann of Styria he headed a group of rebellious nobles, and subsequently in 1245 suffered imprisonment in his own castle of Frauenburg. Ulrich is the author of *Frauentienst*, or *Service of Ladies*, 1255, a prose autobiography describing his loves and adventures from 1222-55 and containing many of his poems, and *Frauenbuch*, or *Book of Ladies*, 1257, a satire. Both are valuable commentaries on the life of the period. The poet died about 1275. See also MINNESINGER.

ULSTER, in Gaelic *Uladh*, a province of Northern Ireland, composed until 1920 of nine counties, but now divided between the IRISH FREE STATE and NORTHERN IRELAND. The province formerly included the counties of Armagh, Antrim, Donegal, Fermanagh, Tyrone, Down, Cavan, Monaghan and Londonderry. After the passage of the Government of Ireland Act, 1920, the Irish Free State claimed Donegal, Cavan and Monaghan, and the remaining six counties were formed into Northern Ireland. In ancient times Ulster was a provincial kingdom. In the 5th century it was divided into three parts, Oriel, Ulidia and Tir Eoghian. The O'Neills of Tir Eoghian and later the O'Donnells ruled Ulster

through most of the Middle Ages. After 1607 the conquered province was converted into plantations by the Scotch and English. The principal industries of the present counties of Donegal, Cavan and Monaghan are distilling, linen manufacture, fishing and the raising of live stock. The three counties return 15 members to Dáil Eireann. Their combined pop., 1926, was 300,091. Pop. of Ulster, or Northern Ireland, 1926, 1,256,561.

ULTIMA THULE, a term used by ancient geographers to denote the geographical end of the earth. It was placed in the northernmost part of Europe, and has been identified both with Iceland and with the island of Mainland in the Shetland group.

ULTIMATUM, a demand by one power of another, with the suggestion that a rejection of the demand will result in war. Where a definite time limit is set for a reply after which hostilities shall begin, the ultimatum is a limited or conditional declaration of war. Where the demand is rejected or ignored, the demanding state may proceed as if war had been declared. The ultimatum may be accepted in full or under protest, or conditionally, with a view to negotiations concerning the softening of the terms of demand.

ULTRA-MICROSCOPE, a MICROSCOPE differing from the ordinary type in the method of illumination. The object is strongly illuminated by a beam of light so directed that none of it, when undeviated, enters the objective. Consequently, if the object is homogeneous, the field will appear dark. If, however, the object contains colloidal material or other small particles, they will scatter light, and this scattered light will enter the objective. Hence, the particles will be made visible as points of light on a dark background. Only the existence of the particles, and not their shape or structure, is made visible. The ultra-microscope makes it possible to show the existence of particles smaller in diameter than the limit of resolution (see RESOLVING POWER) of the microscope. I. C. G.

ULTRAMONTANISM, or the belief of the Ultramontanists, that principle held by Roman Catholics who maintained the pope's supremacy in the Church in opposition to the Gallicanists, who would restrain papal powers by the national churches. (See GALLICANISM.) The Vatican Council of 1869-70 virtually made the Ultramontane position a dogma of the church, so that modern Catholic scholars can assert, "Those who combat Ultramontanism are in fact combating Catholicism." They maintain that the pope is superior to and independent of the decrees of general councils and is the source of all jurisdiction. In regard to the old controversies concerning the pope's temporal powers, the Ultramontanists believe that it is neither honest nor scientific to invoke certain facts in medieval history, which may be explained by peculiar conditions, or by rights which the Holy See possessed in the Middle Ages, when discussing this subject to-day. They affirm that the ancient right of popes to confer the imperial crown, for example, should not enter into the discussion. The term "Ultra-

montane" is necessarily relative. To most nations north of the Alps it refers to the pope, dwelling "beyond the mountains," but in the Middle Ages when a non-Italian Pope was elected he was said to be *papa-ultramontano*. The opponents of the Ultramontanists are sometimes called Cisalpiners. In German political circles the Center is often called the Ultramontane Party, because of its opposition to legislation inimical to the Catholic Church.

ULTRA-VIOLET LIGHT. See ELECTROMAGNETIC SPECTRUM. For the therapeutic uses see HELIOTHERAPY; LIGHT, ARTIFICIAL, IN TREATMENT OF DISEASE.

ULTRA VIRES, a term frequently used in connection with the law of corporations but applicable under certain circumstances to individuals, denoting an action beyond the legal or constitutional power of the individual or corporation. Thus a municipal official who attempts to exercise a power not granted in the municipal charter may be said to be acting *ultra vires*.

ULUGH BEG, MIRZA MOHAMMED TARA-JAI (1394-1449), King of Turkestan, and astronomer, was born at Sultuniya, the son of Shah Rokh Mirza and the grandson of Tamerlane. (See TIMUR.) While governing the western province of his father's realm, he attracted a number of important astronomers to Samarkand, where he built an observatory. Ulugh Beg had Saladin Kazizadeg Roumi revise all existing astronomical tables, and published a new star catalogue, containing the positions of nearly 1,000 stars, and the first since Ptolemy's *Almagest*. He succeeded to the throne in 1446 and, though at first successful in the continuous wars he had to wage, he finally quarreled with his son, Abd-el-Latif, whom he suspected of treachery, and was defeated and put to death by him.

ULYSSES or ULIXES, in Roman mythology, the name given to the Greek hero ODYSSEUS, whose journey and adventures are celebrated by Homer in the *Odyssey*.

UMATILLA, a North American Indian tribe of the Shahaptian linguistic stock, still fairly numerous. They now live on a reservation of that name in the northeastern part of Oregon, and occupy themselves with farming, stock and horse-raising. They lived formerly along the Umatilla and Columbia rivers in Oregon.

UMBRA, the darkest, central part of the shadow of the earth or the moon, where no direct sunlight can penetrate, as contrasted to the PENUMBRA or half shadow.

UMBRELLA BIRD, a genus (*Cephalopterus*) of remarkable birds of the chatterer family, *Cotingidae*, allied to the bell birds, native to Central and South America. There are three known species, all about the size of a crow, with rich black plumage. They are characterized by a large forward-curving crest of hairlike feathers, which practically hides the bill, and a feathered lappet, sometimes a foot long, hanging down from the throat. The best-known species,

the Amazonian umbrella bird (*C. ornatus*), ranges from Guiana and central Brazil through the Amazon region to eastern Ecuador. It has a breast lappet 6 in. long and white-shafted crest feathers. Shy in habit and disposition, it frequents the tops of high forest trees, uttering loud, piping notes and feeding upon fruits. On a platform of small branches, placed in a tree-top, it lays four white eggs.

UMBRELLA PLANT (*Cyperus alternifolius*), a stout perennial of the sedge family, closely allied to the Papyrus, widely grown as an ornamental. It is a native of Africa widely naturalized in the West Indies and in South America. The erect, grooved stems, 2 to 4 ft. high, covered below with leafless sheaths, terminate above in a circle of long spreading leaves giving the plant its umbrella-like appearance. Interspersed with the leaves are short, slender flower-stalks bearing small, flattened flowering spikelets. Several varieties are commonly grown in the North as pot and porch plants; in the Southern states and in California the plants are hardy in the open. See CYPERUS.

UMBRELLA TREE, a name given in the southern United States to two species of MAGNOLIA (*M. tripetala* and *M. Fraseri*), both of which are also called cucumber tree. The name is also applied to various other trees having their leaves or leaf parts arranged somewhat in the form of an umbrella.

UMBRIAN SCHOOL OF PAINTING, not a school in the sense of being founded by a definite master at a fixed time and place, but rather a gradual externalizing of the spirit of "gentle Umbria" which produced two of the loveliest blossoms of RENAISSANCE efflorescence. The artists of Umbria were endowed with a gift for creating a sense of spacious calm and an atmosphere of golden sunshine which the more intellectual schools could not approach through the application of the laws of perspective, line and color. They also created the Umbrian type of madonna, expressive of a human tenderness neither divine nor earthly: the prototype of Raphael's *Madonna*, which has never been surpassed. The first native artist to be greatly esteemed was Gentile da Fabriano in the latter part of the 15th century. A number of artists followed of general high average, culminating with Perugino, his assistant Pintoricchio, and Raphael. A group of painters turned to Florence, where anatomical studies and naturalistic technique was being developed. They were known as the Umbro-Florentines. Among the more celebrated were Piero della Francesca and his pupils Melozzo da Forlì and Luca Signorelli.

UMIAK, the large open "woman's" boat of the Eskimo, constructed in summer of a framework of whale ribs or driftwood over which is stretched a covering of seal hide. The boat is propelled with oars; sometimes a sail made of seal intestines is used. In contrast to the KAYAK, which was the Eskimo hunting-boat, the umiak was used for general purposes of transportation. The boats are fairly seaworthy, but the skin cover requires frequent drying

out to prevent rotting. When the umiak is not in use in winter the skin cover is removed and stored until needed again. In relatively recent times the umiak appears to have been more a characteristic of the western than the eastern Eskimo.

UMPQUA, a North American Indian tribe belonging to the coast division of the Athapascan linguistic stock, who lived formerly on the Upper Umpqua River in Oregon. Depending mainly on the products of the river for food, they lived mainly in board and mat covered houses. The survivors are gathered in the Grande Ronde Reservation in Oregon.

UNALACHTIGO, a tribe of North American Indians constituting the most southern of the three divisions of the DELAWARE tribes and belonging to the Algonkian linguistic stock. Their totem was a turkey, hence they were often referred to as the Turkey tribe of the Delaware. Their territory included the region west of the Delaware River in what is now the State of Delaware, and, after the invasions of the CONESTOGA, they also occupied the east bank of the river in New Jersey. Chikohoki, on the present site of Burlington, N.J., was their principal town.

UNALASKA, a dialectic division of the ALEUT. The Unalaska occupy the Aleutian Islands west of Ataka and the easternmost end and north coast of the Alaskan peninsula. Culturally, physically and linguistically they are closely affiliated with the Kaniagmiut, an Eskimo group.

UNAMI, a North American Indian tribe, one of the important divisions of the DELAWARE, speaking a dialect of the Algonkian linguistic stock. Because of confusion with the tribal totem animal, the turtle, they have sometimes been called the Turtle tribe of the Delaware. They occupied formerly the Pennsylvania banks of the Delaware River from its junction with the Lehigh southward to the Delaware boundary. They are now extinct.

UNAMUNO, MIGUEL DE (1864-), Spanish writer, was born at Bilbao, Sept. 29, 1864. He studied philosophy at Madrid University, and from 1884-91 taught at Bilbao. In 1891 he was appointed Professor of Greek at Salamanca University, subsequently becoming Rector. On account of his daring tirades against the Government, he was deported to the island of Fuerteventura in 1924, escaping however to France, where he remained until the Revolution of 1931. An untiring journalist, Unamuno ranks as one of the great Spanish writers, in spite of a singularly harsh and difficult style. His play, adapted from his novel, *Nada mas que todo un hombre* was a striking success in Madrid in 1926.

UNAU, a two-toed SLOTH.

UNCERTAINTY OF PRINCIPLE, a statement giving the extent of error in measuring the position and momentum, mass times velocity, of a small particle such as an ELECTRON. It was deduced by Heisenberg from the theory of WAVE MECHANICS. To illustrate the principle, consider a ball rolling along a table with a known, uniform velocity. If it travels one foot the first minute, its location may be pre-

dicted at the end of the next minute. With a single electron or ATOM, however, this precise prediction is not possible. If its velocity is known with exactitude, its position at any future instant is indeterminable, and vice versa. If there is an uncertainty in both of these measurements, the product of both errors can never be reduced beyond a certain definite amount equal to Planck's constant, $h = 6.55 \times 10^{-27}$. This dilemma appears as a consequence of the discovery of the dual nature, particle and wave character, of electrons and atoms, and sets a limit to possible fine-scale measurements. It invalidates the law of cause and effect when applied to electrons and atoms.

When dealing with bodies of large size, such as a baseball, the magnitude of h is so small, comparatively, that uncertainty is negligible. The refinement of the instruments used in the measurement is the only practical limitation. J. B. H.

UNCLE REMUS, "His Songs and His Sayings," a collection of tales by JOEL CHANDLER HARRIS; published 1880. It is composed of animal stories and Negro legends which are supposed to be told by the old colored man, Uncle Remus, to a little boy. In these droll tales about Brer Rabbit, Brer Fox, Brer 'Possum and others, the author has caught the charm of the Negro and his folk-lore in a way that appeals as strongly to adult readers as to children. The book was followed by two sequels: *Nights With Uncle Remus*, 1883, and *Uncle Remus and His Friends*, 1892.

UNCLE SAM, the national nickname for the people or the government of the United States. It is supposed to have originated during the War of 1812 when a certain citizen of Troy, N.Y., asking what the initials "U.S." on a carton of goods stood for, was told that they represented Uncle Sam, meaning a certain Samuel Wilson, an eccentric, well-known village character.

UNCLE TOM'S CABIN, a novel by HARRIET BEECHER STOWE; published 1852. This book so graphically revealed the horrors of Negro slavery that it aroused a world-wide storm of indignant protest. With numerous dramatic effects, it shows the life of slaves and slave owners through its simple but emotionally convincing story of Uncle Tom, a slave who is sold south by the Shelbys of Kentucky to the kindly St. Clare family, and by the latter is resold to the brutal Simon Legree, under whose inhuman treatment he at last dies. Important characters are "Little Eva" St. Clare, the mischievous Topsy, and Eliza, a slave who crosses the icy Ohio River to freedom.

UNCOMPAGHRE, a division of the Ute Indians belonging to the Shoshonean linguistic stock. They lived formerly in southwestern Colorado chiefly near Los Pinos and are now under the jurisdiction of the Uinta and Ouray agencies in Utah.

"UNCONDITIONAL SURRENDER." At the BATTLE OF FORT DONELSON, Feb. 16, 1862, Gen. Buckner, the Confederate officer in command of the besieged fort, asked of Gen. Grant, the Federal commander, the appointment of a commission to discuss

terms of surrender. Grant replied: "No terms other than an unconditional surrender can be accepted." The phrase, fortuitously adapted to Grant's initials, U. S. G., caught the popular fancy in the northern states, and Grant, highly popular because of the victory, was dubbed "Unconditional Surrender Grant."

UNCONFORMITY, in geology, the contact between two series of rocks which shows that they were formed under different conditions and at different times. The unconformity betrays the fact that there was a period of **EROSION** which separated the two series of formations. This may be shown by the fact that the beds of the lower sedimentary rocks are tilted, and on the planed-off edges of the slanting beds, horizontal strata later were deposited. It is not necessary to have such an angular discordance, and the unconformity may be revealed merely by the sudden change in enclosed fossils, if both series are sedimentary, or by a marked change in the character of the rocks, as from igneous to sedimentary, together with proof of an old erosion surface being given by the presence of such material as **CONGLOMERATE**, produced when the old land sank again beneath the waters. *See also* **SEDIMENTATION**; **GEOLOGY**.

UNCONSCIOUS, not conscious, or with impaired consciousness; also equivalent to subconscious. The term unconscious, when used literally, refers to such conditions as result from severe injury, to the head especially; from the actions of drugs, particularly of anaesthetics; of coma or fainting. The term refers equally to states of markedly lowered or altered consciousness, and shades over to the subconscious. Freud used unconscious as the reservoir of primitive or suppressed ideas, which Jung calls the collective unconscious and in his view comprises racial experiences. *See* **SUBCONSCIOUS**.

UNCONSCIOUS MIND, that part of the mind below the level of consciousness. It nevertheless plays a large part in determining the conscious mind. It is exploited most by psychoanalysis, which considers it as chiefly composed of sex complexes. It is also the seat of numerous other complexes of various sorts. These complexes often become disturbing elements in the emotional and mental life of the individual. By means of the Freudian technique these complexes may be brought to the surface, thus helping the individual to perfect adjustments hitherto obstructed by the operation of the subconscious mind.

UNCTION (Latin *unctio*, anointing), the use of oil in a religious rite. The custom was borrowed from the Jews who used oil in the consecration of priests, kings, prophets and places. Jesus himself anointed with saliva and the Twelve anointed and healed. To-day unction is used by the Roman Catholic Church in baptism, confirmation, ordination, extreme unction and in the consecration of church altars and fonts. It is used by Eastern Orthodox Church at baptism, and by Anglicans in the sacrament of unction.

Both St. Paul and St. John speak of Christians as anointed in a metaphorical sense, but it is a question

whether oil was used by the Apostles in the rite of Christian initiation. In subapostolic times unction was associated with baptism, and postbaptismal unction, believed to impart a special gift of the spirit, was sometimes substituted for the laying on of hands.

The use of oil in the ordination of bishops arose in the 5th century; in the ordination of priests not until the 11th. It was associated with the ideas of complete consecration and endowment with spiritual gifts.

The apostolic custom of anointing the sick developed in Western Christendom into the sacrament of extreme unction, which is administered only to those supposed to be on the point of death. The effect sought is primarily the forgiveness of God for unconfessed sins and the strengthening of the soul, though recovery is sometimes supposed to result. Literally the rite consists in the application of olive oil, consecrated by a bishop, to the eyes, ears, nostrils, mouth, feet and sometimes to other parts of the body thought to have been involved in sin. In the East the effect sought is rather the recovery of the sick and the procedure is somewhat different. The Anglican Church did not altogether abandon the custom of anointing in illness, but allowed it to lapse. It has been revived since the Oxford Movement (c. 1833) and, known as **Unction**, is administered to any who are seriously ill, in the hope that they will be benefited in body as well as in soul.

The custom of anointing kings dates from the 7th century and is partly responsible for the religious reverence with which popular dynasties have been regarded. Both England and France claimed to have a miraculous oil sent from heaven for the express purpose. The last French king to be anointed was Charles X, as Louis-Philippe dispensed with the ceremony. George V and Queen Mary, however, were both anointed with elaborate traditional ceremonies.

UNDERCLAYS, the clay stratum found under **COAL**. It usually contains small rootlets, and sometimes, fossil stumps and tree trunks, the wood being replaced by rock. *See also* **SQUEEZE**.

UNDERCUTTING. In mining coal and salt, machines resembling a big saw are used to make long cuts in the mineral. These may be made near or in the floor or the roof, or in the seam, and are termed, accordingly, undercuts, overcuts or centercuts. Usually the depth of the cut is 5 to 8 ft. After cutting, the coal or salt is blasted loose. *See also* **MINING**, **COAL**; **BLASTING**.

UNDERGROUND RAILROAD, the popular name for the system whereby fugitive slaves from the southern states were enabled to escape into Canada. Houses, called stations, along the routes across the northern states furnished the fugitives shelter; "conductors" provided food and other active assistance; "stockholders" contributed money and clothing. Levi Coffin, called the president, was actively engaged in the work of assisting fugitive slaves for 33 years, and received into his house an average of 100 fugitives annually. Occasional convictions and

heavy fines under the FUGITIVE SLAVE LAW did not deter the participants in the system which was sanctioned by popular sentiment.

UNDERTAKER, one who undertakes the personal service of preparing the bodies of deceased human beings for burial or cremation and making the proper arrangements for funerals. In America, a knowledge of embalming and cremation is generally needed. An understanding of the socially prescribed procedure for funerals is also important. Since he must deal with people during a period of emotional stress, an undertaker should possess, in addition to the skill necessary to his occupation, the human understanding and tact appropriate to an intimate personal service.

UNDER THE ROSE (Latin *sub rosa*), a phrase meaning in complete confidence. In an old legend, Cupid gives a rose to Harpocrates, the god of Silence, wishing him not to reveal the secret of the loves of Venus. Emblem of silence, the rose was sculptured in ancient times on the ceilings of banquet halls, reminding the guests that their confidences were sacred and would be kept.

UNDERTOW, a term applied to the seaward current of water observed on beaches. It is the agency for returning to the sea the huge quantities of water dashed upon the shore by the waves and breakers of the surf. As its name indicates, it runs a little depth below the surface of the water, and since it sometimes persists until comparatively large distances from the shore, it may become very dangerous for swimmers who are carried far out to the open sea by it.

UNDERWATER LIGHTING. The use of light under water is of comparatively recent origin but is increasing rapidly along two distinct lines, deep-water and shallow-water illumination. Incandescent lamps are used as the light sources for both.

Illumination at relatively great depths was first used in salvaging the United States submarine, S-51, off New London, Conn., in 1925. In such cases a lamp with a heavy-walled bulb is used in an open reflector, so that the water pressure bears directly upon the bulb.

For the illumination of relatively shallow water, as in fountains and swimming pools, an ordinary incandescent lamp with a reflector and water-tight housing is usually employed. Underwater illumination of a similar type is used for outlining the landing area of seaplane bases. H. S. B.

UNDERWEAR (KNITTED). See KNITTING.

UNDERWOOD, OSCAR WILDER (1862-1929), American political leader, was born in Louisville, Ky., May 6, 1862. He attended local schools, the Rugby School in Louisville and the University of Virginia. He studied law and in 1884 was admitted to the bar, beginning practice in Birmingham, Ala. In 1894, he was the Democratic candidate for Congress and as the member-elect he served from Mar. 4, 1895 until June 9, 1896 when he was obliged to surrender the seat to Truman H. Aldrich who had successfully contested his election. He was elected

to the national House of Representatives in 1896 and eight times reelected, serving from Mar. 4, 1897 to Mar. 3, 1915. During his last two terms in the House, 1911-15, he was Democratic floor leader and as such was an important factor in the passage of notable legislation, including the creation of the FEDERAL RESERVE SYSTEM. He was chairman of the Committee on Ways and Means which drafted the Tariff Act of 1913 and it was subsequently known popularly as the UNDERWOOD TARIFF ACT. He was elected to the United States Senate in 1914 and reelected in 1920, serving from Mar. 4, 1915 to Mar. 3, 1927. He declined to be a candidate for reelection in 1926. He was floor leader of his party in the Senate, 1921-23. In the Senatorial dispute over the Versailles Treaty, 1919-21, he favored ratification. He represented the United States as a member of the Conference on Limitation of Armament at Washington, 1921-22 and he also represented the United States at the Sixth International Conference of American States at Havana, Cuba, in 1928. He was three times an unsuccessful candidate for the Democratic presidential nomination, 1912, 1920, and 1924. After his retirement from the Senate he lived on his estate near Accotink, Fairfax County, Va., where he died Jan. 25, 1929.

UNDERWOOD TARIFF ACT, enacted Oct. 3, 1913, a Democratic measure reducing the general average of duties from 40% *ad valorem* to 29%. With the Sixty-third Congress, 1913-15, completely controlled by the Democratic Party, opponents of high protection were enabled, for the first time since 1894, to embody their views in a comprehensive statute. President Wilson's leadership was evident in the construction of the measure. The act, which took its name from Representative OSCAR W. UNDERWOOD, chairman of the Ways and Means Committee, attempted to fix rates not according to the traditional party standard of "revenue only," but stressed the principle of "competitive tariff"—an assessment of rates to make the aggregate cost of imported goods equal to, but not in excess of, the cost of domestic production. Wool, leather, boots, shoes, and all agricultural implements were added to the free list. Specific duties on woolen, cotton, and silk goods were discontinued, and *ad valorem* rates on these textiles were reduced. Although the act was in effect nine years, the actual effect upon American business of the withdrawal of high protection could not be determined because of the abnormal character of the war-dominated years.

UNDERWRITING, the act of assuring or guaranteeing the sale of an issue of securities at a stated price. An INVESTMENT BANKER seldom assumes the full risk involved in the sale of an issue of securities. In order to distribute the risk and responsibility, he usually has the issue underwritten by an underwriting SYNDICATE. The underwriting syndicate consists of an association of bankers and security dealers who have undertaken to sell and distribute the issue. The investment banker who is the manager of the syndicate, brings the group together and they, either

wholly or partially, guarantee that the securities will be sold to the public. In case of failure to sell a given issue, each member must take and pay in accordance with the syndicate agreement his proportionate share of the unsold part of the issue. J. M. C.

UNDSET, SIGRID (1882-), Norwegian novelist, was born at Kalundborg, Denmark, May 20, 1882. She grew up in Oslo (Christiania), and her first book, *Fru Marta Oulie*, was published in 1907. This was a novel in the form of a diary and dealt, as do many of her later novels, with the problems of married life. Her first great success came with a daring novel, *Jenny*. After a few more novels and novelettes of comparatively minor importance she found her true field in the historical novel of medieval Norway. The first of these was *Kristin Lavransdatter*, a trilogy comprising *The Bridal Wreath*, *The Mistress of Husaby* and *The Cross*. The action of this novel takes place in Norway in the first half of the 14th century. The author's next work was *The Master of Hestviken*, a tetralogy. In her next novel, *Gymnadenia*, and in its sequel, *The Burning Bush*, she turned again to modern life. The esteem in which Mrs. Undset's work is held in the Scandinavian countries is shown by the award to her of the Nobel Prize in 1928. An English translation of *Gymnadenia*, under the title *The Wild Orchid*, was published in 1931.

UNDULANT FEVER, or **MALTA FEVER**, an infective febrile disease of long duration caused by the drinking of goats' milk infected with the bacterium *Micrococcus melitensis*. It is practically limited to the shores of the Mediterranean and other regions subsisting largely on the milk of goats. The fever is of a very irregular type, but reaches a temperature of 105°F. It is accompanied by constipation, muscular pains, perspiration, and disordered digestion. Relapses are frequent and recovery slow, but it is rarely fatal. There is no effective treatment, but the disease can easily be prevented by boiling all milk. The adoption of this simple expedient enabled the British navy to reduce the number of cases from 480 in 1904 to twelve in 1907. See also **TROPICAL DISEASES**.

UNEARNED INCREMENT, a term referring to that increase in the value of anything subject to a natural monopoly which is due not to the expenditure of CAPITAL, labor or skill by the proprietor, but to the general progress of society resulting in an increased demand for that thing. Theoretically the increase in the value of any property, for instance stock shares or a rare book, which is not due to productive effort of the owner is unearned increment. The term is generally confined, however, to increase in land values, since these constitute the clearest case of getting something for nothing. Few economists hold that all increase in land value is unearned increment, but there are few who do not admit that a large part of such increase is unearned by the owner. Proposals for the social appropriation of values which society itself creates by the mere process of growth and increased demand encounter, not theoretical, but practical difficulties. Present owners of land, if they have

not inherited it, have generally paid what they regarded a fair price for it, the capitalized value of its rent. To expropriate these owners without reimbursement would obviously be unjust. Similar objection does not hold against the social appropriation of future increases of value, where it can clearly be shown that the increase is due to social movement rather than to something the owner has done. The objection usually raised against this is the difficulty of measuring the socially produced increase.

A. B. W.

UNEMPLOYMENT, in its more specialized meaning, industrial idleness on the part of those able and willing to work, whose failure to effect a wage or salary contract is primarily due to lack of work opportunities. In its more comprehensive meaning, unemployment includes worklessness due to unemployment, labor disputes, and the like, and also underemployment, which is unemployment within employment. The specialized meaning has developed from recognition of the economic as contrasted with the personal factors operating in the case of the large number who, though seeking work, are unable to find it, and who, cut off from economic support, see their thrift penalized and their families paying in health, education and unity.

Various types of unemployment may be distinguished. Seasonal unemployment recurs year after year in almost all industries with losses resulting to labor and management. Methods to combat it are storage (soap), advertising and sales policies (paints), side lines and fillers (paper goods), dovetailing industries (coal and ice), changes in technique (building construction), plus the managerial policies of advance planning and budgeting (see **BUSINESS FORECASTING**) of production and sales, flexibility of working hours and a guaranteed number of weeks' work.

TECHNOLOGICAL UNEMPLOYMENT is that which arises in connection with mechanical and managerial improvements or mergers displacing manual workers and also clerical workers and salaried officers. Fear of permanent accumulation of unemployment from technological or evolutionary improvements is claimed to be without foundation because the resulting economies will cheapen the product, thus enlarging the scale of production and also from the increased profits creating a market for other industries, both of these tendencies absorbing the displaced workers. But these adjustments take time, and immediate effects may be tragic when skill and experience give way to the machine and youth. Remedies vary from managerial responsibility in advance planning and timing to reeducation, i.e., teamsters becoming licensed truck drivers, vocational guidance, adequate employment offices informed and prepared to cope with major movements, the dismissal wage in terms of money and service, and a wage policy giving to labor the fruits of technological advance, thus sustaining the market with adequate buying power and moderating the rate at which investment in labor-displacing capital will take place.

Cyclical unemployment, appearing with every major and minor downswing of the BUSINESS CYCLE, engulfs the largest number of workers and is the most exhausting to their resources. Instead of two unemployed out of each hundred of those attached to industry there are forty. Some remedies are identified with theories of the business cycle. From the monetary theory comes the proposal for the stabilization of prices by control of money and credit; from the underconsumption theory, the proposals for the redistribution of wealth and income through advancing wages and progressive taxation of income and inheritance; from emphasis on the rôle played by mistaken optimism and blind estimates comes the demand for improved statistics and centralized planning.

The advance planning and financing of public works should cushion the business cycle both through work provided and buying power sustained. Public works have the advantage of being one of the major industries of the country, nearly comparable in size with the automobile industry, and constituting 40% of all building and other construction. A public works policy presupposes adequate prosperity reserves, scientific timing in accordance with requisite statistical indexes and the maintaining of normal standards of efficiency. Public works may be supplemented by quasi-public works such as housing projects and repair, maintenance and enlargement activities of corporations timed for the same purpose.

UNEMPLOYMENT INSURANCE or reserves are designed to steady the purchasing power of labor and reweight the financial incentives of management by causing it to include overhead costs of labor along with the other costs of production. Otherwise the laborer, the corner grocer and the community chest are in effect subsidizing the creation of unemployment.

In connection with all forms of unemployment, the adequate organization of the labor market is of fundamental importance. The Rochester experiment (see EMPLOYMENT EXCHANGE) with public employment offices illustrates the new emphasis on ample industrial information, technique of placement and vocational guidance.

The paradox of millions in want and hunger while others are being impoverished by storage and interest charges on food and clothing which they cannot sell is being urged against the long accepted theory that social welfare is best brought about as a by-product of enlightened self-interest in favor of emphasis on the necessity of a planned and controlled economic system, consciously directed toward social well-being.

F. P.

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UNEMPLOYMENT INSURANCE, a form of insurance originating in the out-of-work benefits paid to their members by certain European LABOR UNIONS during the 19th century. These trade union and other cooperative unemployment funds were sub-

sidized in some countries by the local or the national government or by both; although many of them are still financed by their members. By 1930 governmental subsidies were given to voluntary schemes in Belgium, Czechoslovakia, Denmark, Finland, France, Luxemburg, the Netherlands, Norway, Spain and Switzerland. In 1930, 20 countries were giving governmental support to some form of unemployment insurance. National compulsory systems were established first by Great Britain in 1911 and later by Austria, Bulgaria, Germany, Irish Free State, Italy, Mexico, Poland, Queensland and Russia. Certain groups of workers are excluded, particularly those in agricultural and domestic occupations. Methods of financing vary in different countries, the cost being borne by the worker, the employer or the state, singly or jointly. In the United States, no legislation has been enacted in Congress or any state providing unemployment insurance or granting subsidies to voluntary funds, although bills have been introduced in recent years, particularly during the depression period following 1929.

In 1930 four labor unions had national schemes of out-of-work benefits in the United States, although at least 11 unions have paid such benefits during varying periods in the past and a number of local unions have done so—a few for many years. Two other types of voluntary unemployment insurance have also been experimented with. At the beginning of 1931 about 30 employers, including two cooperative groups, had unemployment funds paying benefits to employees, or paying them out of operating expenses, during layoffs for varying specified periods. The other type involves establishment of a fund, sometimes financed jointly, but more frequently by employers, under joint agreement between a union and employers or one or more EMPLOYERS' ASSOCIATIONS.

L. H. M.

BIBLIOGRAPHY.—B. M. Stewart, *Unemployment Benefits in the United States*, 1930; International Labor Office, *Unemployment Insurance, Tabular Analysis of Legislation in Force*.

UNFAIR COMPETITION, business methods which interfere with the working of a freely competitive system. These methods have often destroyed economically efficient as well as inefficient organizations and are considered contrary to the public interest. As a result, governments have provided for regulation intended to maintain free competition.

Simple agreements to restrain trade, pools, trusts and holding companies were held to be illegal at common law, but attempts to control the market in the United States became of such magnitude that Congress passed the SHERMAN ANTITRUST ACT of 1890. This was supplemented in 1914 by the CLAYTON and FEDERAL TRADE COMMISSION ACTS.

The most significant provision of the Federal Trade Commission Act is Section 5, which provides that unfair methods of competition in commerce shall be declared unlawful. Business is commanded to compete fairly and the act is aimed at methods rather than at persons. Prior to 1914 unfair methods were

enjoined or damages procured through individual actions in courts, whereas the function of the Federal Trade Commission, which is created to administer the act, is remedial rather than punitive. To be unfair within the meaning of the act, the particular practice complained of must be unfair to the public and the wrong must be of such a nature that it would substantially lessen competition or unduly restrain trade.

Decisions are made in accordance with practices, usages, and customs peculiar to a particular industry, but any classification of unfair competition would include price cutting, excessive credits, resale price fixing, bogus independents, exclusive dealing, full line forcing, rebates, price discrimination, exclusive dealer arrangement, inducing breach of contract, misrepresentation, misleading advertising, acquiring stock in competing companies, fixing channels of trade, intimidation, misbranding, basing point price system and typing contracts.

P. R. O.

BIBLIOGRAPHY.—National Industrial Conference Board, *Public Regulation of Competitive Practices*, revised edition; Joseph E. Davies, *Trust Laws and Unfair Competition*, 1916; C. G. Henderson, *The Federal Trade Commission*, 1924.

UNGAVA, the northern part of the province of Quebec, bounded by Hudson Strait and Ungava Bay on the north, Labrador on the east and Hudson Bay on the west. In 1912, when it was annexed to the province of Quebec under the Quebec Boundaries Extension Act, the area was estimated at 351,780 sq. mi. Later, the region was made into the territory known as New Quebec. In 1927, at the settlement of the boundary dispute between Canada and Newfoundland, much of the area of Ungava was awarded to Labrador.

UNGULATA, the scientific name for a large group or super-order of placental mammals. Typical ungulates have hoofs on their feet instead of nails or claws; they walk on all fours and feed on vegetables. Such forms as the horse are the mammals most highly specialized for land living. The great

majority are terrestrial. Members of one order (Sirenia) are aquatic, and some hyraxes are arboreal. The ungulata include the following orders: (1) Artiodactyla—Even-toed ungulates, such as pigs, deer, cattle. (2) Perissodactyla—Odd-toed ungulates, as horses, tapirs and rhinoceroses. (3) Proboscidea—Elephants. (4) Sirenia—Aquatic ungulates, as sea-cows and dugongs. (5) Hyracoidea—Small ungulates, as the hyraxes.



P. A. RYDBERG, "FLORA OF PRAIRIES AND PLAINS"
UNICORN PLANT

UNICORN PLANT (*Proboscidea louisiana*), a coarse sticky-hairy annual of the martynia family, called also proboscis flower and devil's-claw, some-

times grown for its oddity. It is native from Indiana to Utah southward to Texas and California. The low, widely spreading branches, 2 to 3 ft. long, bear large, roundish heart-shaped leaves; showy yellowish-purple flowers in axillary clusters and pendulous, somewhat woody fruit-pods, about 3 in. in length, with a long curved beak. When dry the beak splits into two hooklike spines. The tender young pods are sometimes pickled like cucumbers.

UNICURSAL FIGURE, a geometric figure which can be described by a point which so moves that it will pass along each line in it once and only once. For example, in Fig. 1 the first figure is unicursal, but the second is not:

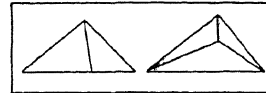


FIG. 1

One of the best-known of the problems connected with the subject was considered by EULER in 1736. According to this, a man was required to take a walk

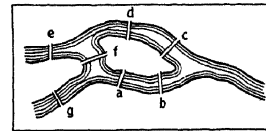


FIG. 2

in Königsberg so as to cross each of its bridges (*a, b, c, d, e, f, g*) once and only once (Fig. 2). Euler showed that it was impossible and gave the mathematical rea-

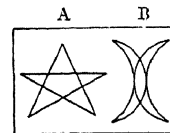


FIG. 3

sons. Among the well-known historical unicursal figures is the Pythagorean badge, or the pentagram star, and the seal of Mohammed, shown in Fig. 3.

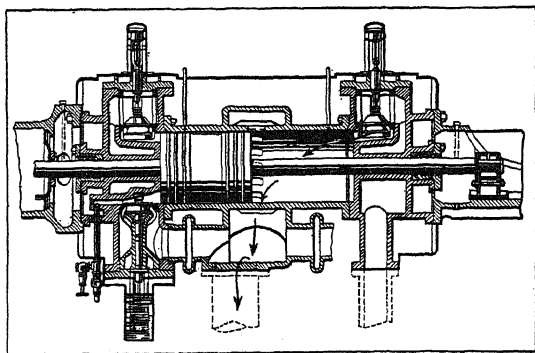
See W. W. R. Ball, *Mathematical Recreations and Essays*, 5th ed., 1911.

UNIFIED-FIELD THEORY. EINSTEIN has discovered a general system of mathematical equations which present a common background for all physical activity. This comprehensive framework for the expression of the physical laws of the universe is known as the Unified-Field Theory and includes, as special cases, the previously known, but heretofore isolated, expressions for ELECTROMAGNETIC WAVES. See also GRAVITATION; SPACE-TIME.

UNIFLOW ENGINE, a STEAM ENGINE in which the flow of steam from the inlet valve to the exhaust port is unidirectional. Non-uniflow engines, wherein steam enters and leaves the cylinders through valves located close to or in the cylinder head, suffer a loss in efficiency due to condensation of the steam within

the cylinder. When steam expands it undergoes a reduction in temperature; consequently at the end of the expansion, the cylinder is filled with steam at, say, a pressure of 30 pounds and a temperature of 240° F. As steam sweeps toward the exhaust valve located in the cylinder end, it picks up heat from the cylinder barrel and head, cooling these parts to approximately 250° F. Then when live steam is admitted at, say, a pressure of 200 pounds and a temperature of 425° F., the iron walls absorb part of its heat, resulting in condensation. From 30 to 50% of the steam used by an engine is lost in this manner.

The uniflow engine has a cylinder twice as long as the piston stroke and a piston of a length equal to the stroke. Steam is admitted at the cylinder head and, after expanding, flows out through center ports. The expanded steam does not sweep back across the hot cylinder head, and condensation losses are reduced.



TYPICAL UNIFLOW CYLINDER

On the following stroke, which in other types of engines is employed to force the exhaust steam from the cylinders, the steam trapped in the cylinder is compressed to a pressure equal to the boiler pressure. The figure shows a typical uniflow cylinder. Actual engines vary in the design of their valve mechanisms and in various details of mechanical design.

L. H. Mo.

UNIFORMS: MILITARY AND NAVAL. The uniforms to be worn in the United States Army, Navy, and Marine Corps are prescribed in regulations issued by the War and Navy Departments and the Headquarters of the Marine Corps, respectively.

Officers provide their own uniforms. The uniforms of other grades are provided by the government from appropriations made for the purpose by Congress. The uniforms in use in the Army may be classified broadly as required and optional.

The service uniform is prescribed and required for habitual wear by all throughout the Army. It is of two kinds: woolen, olive drab in color, for wear except in tropical or sub-tropical climates; and cotton, khaki colored, for wear in warm climates.

The optional uniforms are the white uniform, for wear by officers, in warm climates, when not on duty with troops under arms; and the dress, full dress, mess and special evening dress uniforms. The name

of each of the four last mentioned suggests the occasion for its use.

The Army uniforms listed as optional were prescribed and required before the World War. Their use was suspended during that war. For reasons of economy they have not, since the close of the war, been again placed in the list of required uniforms.

In both the Navy and the Marine Corps uniforms of types corresponding to those of the Army, both the required and the optional, are prescribed and required. E. A. K.

UNION, a city and the county seat of Union Co. in northwestern South Carolina, situated 65 mi. northwest of Columbia. Two railroads serve the city. The city is a textile manufacturing center. Vegetables and cotton are the chief crops of the district. The beautiful Blue Ridge Mountains lie in the vicinity. Pop. 1920, 6,141; 1930, 7,419.

UNION, ACT OF, 1707. See ENGLAND, HISTORY OF.

UNION ACT OF 1840, "to reunite the provinces of Upper and Lower Canada," the organic act establishing the Canadian government from 1840 until 1867. Lord John Russell in the summer of 1839 introduced this bill, modeled after Durham's Report, into the British Parliament, and dispatched Poulett Thomson (created Baron Sydenham in 1840) to Canada to prepare local opinion to accept the change. Parliament passed the Union Act on July 23, 1840, to become effective Feb. 10, 1841. The single government was to comprise a governor and legislative council of not less than twenty members appointed by the Crown, and a House of Assembly of 84 members, 42 from each of the old provinces, to be elected by popular suffrage by districts. The English language alone was permitted in legislative records, although both French and English were allowed in debate. The Crown formally surrendered all claims to hereditary and territorial revenues in return for the assumption by Canada of a permanent civil list of £75,000. Taxes on the people could be levied only for the benefit of the province; all bills for taxation and expenditures were to originate with the governor, and were to be submitted to the House of Assembly for discussion. England reserved the right to levy duties for the purpose of regulating imperial commerce, and bills concerning the crown lands and concerning religion were to be reserved by the governor for the pleasure of the Crown. The debts of the old provinces were assumed by the new government, and old laws were to continue in force in each province until revised or repealed.

No reference was made to responsible government, the essential issue of the REBELLION OF 1837. Other demands of the insurgents were unfulfilled: the legislative council remained an appointive body; no provision excluded civil and judicial officers from concurrently holding legislative positions. Equal representation in the assembly had been an absolute demand of Upper Canada as the price of union, but in Lower Canada the French-Canadians in particular objected

to the disproportionate representation, and to the assumption of the heavy public debt of the upper province by the consolidated treasury. The act ended the hitherto irrepressible friction between the two provinces over division of the customs proceeds, and, broadening the political horizons of all voters, did much to destroy regional limitations of thought.

UNION CITY, a city of Hudson Co., N.J., situated on high ground overlooking the Hudson River and New York City and adjoining Jersey City on the north. Its transportation facilities include electric trolleys and motor bus lines with direct connections to the New York ferries and Hudson tubes. It is also served by the West Shore and Lackawanna and Erie railroads, their respective terminal yards of Weehawken, Hoboken and Jersey City being immediately adjacent. It is the residence of many New York and Jersey City workers and has a great number of industrial establishments, the varied products of which were valued at approximately \$19,000,000 in 1929, the most important of these being silks and textiles. The retail trade in 1929 amounted to \$39,142,391. Union City was incorporated in 1925, the consolidation of the town of West Hoboken with a population in 1920 of 40,074 and of Union with a population of 20,651. Union was incorporated as a town in 1864 and West Hoboken in 1884. Pop. 1920, 20,651; 1930, 58,659.

UNION CITY, a city in northwestern Tennessee, the county seat of Obion Co., situated 58 mi. northwest of Jackson. Bus lines and two railroads serve the city, which is a shipping center for grain, cotton and sweet potatoes. The chief local manufactures are shoes, clothing and raincoats; there are also packing houses. Union City was founded in 1854 and incorporated in 1861. During the Civil War the Confederate forces captured the city on two occasions. Reelfoot Lake, near by, which came into existence after an earthquake in 1811, is fed by the Mississippi River: it became a State Game Preserve in 1920. Pop. 1920, 4,412; 1930, 5,865.

UNION COLLEGE, at Schenectady, N.Y., an institution for men founded in 1795, was one of the first colleges incorporated in New York State. It was so named because several religious denominations co-operated in its organization. In 1873 Union College became a part of Union University. It had productive funds in 1931 amounting to \$3,500,000. The library of 70,000 volumes contains the Bailey collection of American wit and humor. In 1931-32 there were 826 students, and a faculty of 83, headed by Pres. Frank P. Day.

UNION JACK, the national flag of Great Britain or the United Kingdom, used throughout the British Empire. It is formed by the union of the cross of St. George (red on a white ground), the diagonal cross or saltier of St. Andrew, representing Scotland (white on a blue ground), and the saltier of St. Patrick of Ireland (red on a white ground). In its present form it was first flown in 1801.

UNION LABOR PARTY, organized in 1888 by

the union of the GREENBACK PARTY with certain city trades union organizations. Its presidential ticket in 1888 polled 146,935 votes. After participating insignificantly in two gubernatorial elections, Wisconsin, 1890, and New York, 1891, the party disappeared. Its rural support became POPULISTS and its trades union constituents joined the SOCIALIST LABOR PARTY.

UNION OF SOCIALIST SOVIET REPUBLICS, THE (U.S.S.R.). Judged by the economic evolution through which the new state has passed, the history of the Union of Soviet Republics falls naturally into three stages.

First Phase. The first phase, that of militant Communism, lasted from the Bolshevik *coup d'état* of Nov. 7, 1917, to Lenin's (see LENIN, VLADIMIR) adoption of the so-called New Economic Policy on Mar. 21, 1921. This period was one of transition and improvisation, marked by conflict with unsympathetic bourgeois elements within, by the open hostility of the Entente Powers and their futile military intervention, by the threat of gradually dwindling White armies not only on the south and west fronts but also in Siberia, and finally, by open war with Poland. The Soviet State was obliged to maintain 3,000,000 men under arms, and at times as much as 60 per cent of the national railway mileage was in enemy hands. Already pronounced at the outbreak of the revolution, the economic disorganization of the country was aggravated to a point where food and fuel shortage was chronic, while the output of nationalized industry was less than one-fifth of prewar production. Peasant hostility to the Communist system resulted in constant rural uprisings, and since the harvests yielded only half the grain of a normal prewar year, famine beset the urban centers.

Second Phase. In Mar., 1921, upon the conclusion of peace with Poland, Lenin, then the dominant figure in the Bolshevik party, decided to compromise with expediency to the extent of allowing the peasants to sell their grain freely after paying a heavy tax in kind. At the same time he admitted a considerable degree of private initiative in normal commercial operations. While interpreted abroad as a surrender to capitalistic principles, the New Economic Policy was not so regarded by leading Communists, who have always been ready to modify their outward procedure without abandoning their basic theory. The beneficent effects of this altered policy were at first offset by the famine winter of 1921-22, during which large scale American aid was received. A more productive harvest in 1922 alleviated in some measure the critical food situation, and during 1923-24 the gradual replacement of the old depreciated ruble by the ostensibly stable *chervonetz* currency further favored the progress of business recovery. Among the fundamental principles of the New Economic Policy Lenin included the industrialization of the country, complete reform of the technical and social basis of agriculture, and subjection of the whole national economy to a coherent and unified plan. The evolution of such a project which should govern economic operations over a five-year

period was conceived during the initial stages of the New Economic Policy, but it was not until 1928 that a plan of this nature was put into operation, thus ending the second phase of Soviet history, during which the operation of the New Economic Policy promoted a volume of reconstruction which restored industrial output substantially to the prewar level.

This period of reconstruction, 1921-28, was accompanied by crucial developments in internal political organization and in the diplomatic prestige of the Soviet Government. The federative structure of the republic was definitively established at the close of 1922. The Federal constitution was adopted on July 6, 1923. The disposition of the Western Powers to conclude a truce with Communism in return for commercial advantages was exemplified by the Anglo-Russian commercial treaty of 1921 as well as by similar contemporary accords with Germany and with the Scandinavian and Baltic states. The American official attitude toward Soviet recognition was emphatically negative from 1920 forward, but there has never been any disinclination on the part of American firms to accept contracts from the Soviet Government when sound terms of payment can be arranged. Russian representatives attended the Genoa Conference in Apr. 1922; though unable to negotiate any settlement regarding foreign debts and loans, they nevertheless brought home the Treaty of Rapallo with Germany, which was interpreted as the first effective safeguard against the isolation of Moscow from the West. *De jure* recognition by the British Government, by Italy, and by France ensued in 1924, and the Scandinavian countries followed suit. Closer relations with Chinese factions were successfully initiated. A general treaty with Japan was signed in Jan. 1925. The Soviet Union participated in the Lausanne negotiations, and in general succeeded in establishing itself as a major factor both in European diplomacy and in Far Eastern affairs. From 1926 forward, however, Soviet diplomatic progress was retarded. Russian projects in China were checkmated. The British Conservative Cabinet broke with Moscow in May 1927, and relations with France simultaneously became strained. Accords with Asiatic states, Turkey, Persia and Afghanistan, hardly offset either these western rebuffs or the failure of Soviet propaganda in China. Russian plenipotentiaries at the various disarmament conferences, and the resumption of diplomatic relations with Great Britain in 1929 failed to contribute measurably toward any reconciliation between Moscow and the Great Powers.

The evolution of the Soviet State under the domination of the Communist Party was marred by aggressive measures of repression and discrimination directed against survivors of the pre-revolutionary ruling classes and the bourgeoisie. Considerable foreign resentment was provoked by Communist measures aiming at the elimination not only of the Russian Orthodox Church but also of all religious activities of whatever sort in favor of complete atheism. This antireligious attitude is compensated in an appreciable degree by zealous

promotion of social welfare schemes and a resolute fight against illiteracy undertaken by the Soviet Government itself, while Russian historical and artistic monuments have for the most part been carefully preserved, even when constituting conspicuous commercial assets to an impoverished state.

The internal consolidation and the diplomatic offensive of the Soviet Union did not proceed without factional disagreements within the Communist Party itself. Lenin died in Jan. 1924; his genius for compromise, so well exemplified in the New Economic Policy, had raised the nation from the slough into which revolution and war had cast it. The contested succession to the great leader devolved upon JOSEPH STALIN, who successfully overcame the opposition of LEON TROTSKY and his associates, whose defeat and exile eliminated from the Communist Party all elements opposed to the principles laid down by Stalin.

Third Phase. The third phase of Soviet development, namely, the epoch of a planned national economy introduced by the FIVE YEAR PLAN, thus began in Oct. 1928 under Stalin's leadership. The aim of this plan is to make Russia a self-contained industrial state fed by the modernized agricultural output, one phase of which includes a system of large collective farms manned by a peasant proletariat. Despite the relative success of the Five Year Plan, excessive emphasis on the development of heavy industry, coupled with the necessity of large exports to pay for foreign industrial equipment, has unduly depressed the domestic living standard. At the same time, ruthless forcing of the peasantry into collective farming brought on a rural crisis in 1929-30 which was relieved only by a sudden judicious cut in the *tempo* of collectivization. As a consequence of the inability of the Soviet Government to secure adequate long-term foreign credits, the Soviet authorities have paid for their foreign purchases by high-pressure exports of foodstuffs, raw materials and manufactured products at sacrifice prices which contributed toward aggravating the economic crisis throughout the world during 1930-31. In the summer of 1931, as the Five Year Plan progressed, the Soviet Government was able to moderate its restrictions on the domestic sale of foodstuffs and manufactures, and endeavored to stimulate industrial efficiency by wage increases and bonuses. Discrimination against technical personnel of middle-class origin was likewise abridged. The Soviet Union, under the control of the Communist Party, has now reached a status of administrative stability, but is in the midst of an experimental economic evolution of which the final results, both domestic and international, will not be determined for some years to come. S. H. C.

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GOVERNMENT OF THE U.S.S.R.

The sovereign power of the Union of Socialist Soviet Republics is vested in soviets or councils of dele-

gates of workers and peasants. These bodies had their origin in the Revolution of 1905, which was led by soviets, or strike committees of the workers. Revived in 1917, they now constitute the foundation of the great structure of federal union formed by the Treaty of Union in 1923.

The Soviet Union is made up of the following units: six constituent republics, Russian Socialist Federated Soviet Republic, or Soviet Russia proper, the most important of the group, containing 70% of the population and 92% of the area of the Union; White Russia Socialist Soviet Republic; Ukrainian Socialist Soviet Republic; Transcaucasian Socialist Soviet Republic; Turkoman Socialist Soviet Republic; Usbek Socialist Soviet Republic; 11 autonomous republics and 13 autonomous areas.

The delegates to the soviets are elected every two years. The right to vote is based upon participation in the productive life of the country instead of property. It may not be exercised by anyone who employs labor, or by anyone whose income is derived from interest or rent, by criminals or mentally defective persons or by those who because of former occupation or social origin are supposed to be counter-revolutionary in sympathy. A foreigner who is a worker, however, is not excluded from the franchise provided that he does not belong to one of the excluded classes.

The highest soviet power belongs to the All-Union Congress of Soviets, a parliamentary body of 1,500 members chosen on the basis of one delegate to every 25,000 town electors and one to every 125,000 peasant electors. The discrimination shown in thus favoring the industrial and city workers is repeated throughout the soviet scheme. It is seen in the initial voting of the town and village soviets which forms the first stage of selection of members for the All-Union Congress. This voting takes place in three stages. First the village and town soviets elect delegates to a county (*Uyezdnii*) congress of soviets, on the basis of one delegate for every 1,000 in the villages and one to every 100 in the factory population of the towns. The town soviets are formed on occupational, not district, lines, and are usually composed of workers in a single factory.

The device of the single party slate is presented to the members of the soviets in both towns and villages with no organized opposition. Voting, which is by show of hands, always results in a majority for the approved party choice, although only about one-third of the members of the soviets belong to the Communist Party. The county congress thus elected selects a proportion of its membership to become members of a provincial congress. In the final stage the provincial congresses elect percentages of their delegates to the All-Union Congress.

The body thus created is too huge to function in the traditional manner of parliaments. It meets only once in two years and merely lays down general basic principles for the country's government. It elects the Council of Commissars (the Cabinet for the Union) and the All-Union Central Executive Committee (the

Tsikh), a bicameral body which meets three times a year.

The larger of these two chambers, called the Council of the Union, is chosen from delegates of the six constituent republics in proportion to their population. The smaller, with 100 members, is known as the Council of Nationalities. It is composed of five members from each republic and one from each autonomous region. The two chambers confer by means of joint committees in somewhat the manner in use in the Congress of the United States of America.

The actual work of lawmaking is performed by a still smaller body of great importance, called the Praesidium of the Central Executive Committee. On this committee sit 14 members, half of whom are elected by each branch of the Central Executive Committee who choose seven more, making 21 in all. The functions of the Praesidium are administrative as well as legislative. They extend to the country's revenue and include amnesty and pardon.

It should be noted that the Council of People's Commissars constitutes another lawmaking body. This council functions as the executive organ of the Central Executive Committee, hears reports of the various commissariats, and issues decrees. Its membership includes the Commissars for Foreign Affairs, Army and Navy, Foreign Trade, Transport, Posts and Telegraph, Labor, Finance, Workers and Peasants Inspection and Public Economy, as well as the chairman of the Supreme Economic Council and the director of the Central Statistical Board. It might be assumed that the laws of the Praesidium of the Central Executive Committee and the decrees of this council would be found in conflict; but this possibility is prevented by the fact that all important decisions, whether legislative or executive in character, originate in fact not in these bodies, but in the political bureau of the Communist Party's Executive Committee. The names of the various commissariats indicate their function, with the exception of the Workers' and Peasants' Inspection (*Rabkrin*). This body has the unique rôle of a continual check-up and audit of other state departments. It works with the Control Commission of the Communist Party for the elimination of graft, abuses and inefficiency.

The pattern of government described above—still in process of continual modification—is closely followed in the constitutions of the constituent republics. Each has its own congresses, central executive committee and council of commissars. The republics exercise autonomy with respect to their internal affairs and differ widely in their cultural apparatus. The constituent republics retain the right to withdraw from the Union, but the control of the Union extends over foreign relations, transportation and communications.

A. HE.

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UNION PARTY. See CONSERVATIVE.

UNIONS, LABOR. See LABOR ORGANIZATIONS.

UNIONTOWN, a city and county seat of Fayette Co., Penn., about 50 mi. southeast of Pittsburgh. It is served by the Pennsylvania and the Baltimore and Ohio railroads and an airport. Industrially and agriculturally important, the city's resources also include oil, gas, coal, limestone, iron ore, clays and timber. The manufactures are chiefly radiators and enamelware. In 1929 the factory output reached approximately \$4,000,000; the retail trade amounted to \$20,621,145. Henry Beeson founded the village in 1776; 20 years later, the borough was incorporated and in 1916 Uniontown became a city. It has the commission form of government. The site of Fort Necessity, built in 1754, is nearby, as is also the scene of Braddock's defeat. Albert Gallatin, of President Jefferson's cabinet, resided at Uniontown. A branch of the University of Pittsburgh and a junior college are here. Pop. 1920; 15,692; 1930, 19,544; 10% foreign born.

UNION UNIVERSITY at Jackson, Tenn., a co-educational institution founded in 1845 by the Baptist General Assembly of Tennessee at Murfreesboro. Suspended during the Civil War, the institution was reopened in 1866, and in 1874 was removed to Jackson where it was chartered as the Southwestern Baptist University. The present title was adopted in 1907. Its grounds and buildings were valued in 1931 at \$567,322. In 1930-31 there was a student enrollment of 1,150, and a faculty of 36, headed by Pres. H. E. Watters.

UNISON, in music, the sounding of two or more voices, or parts, at the same PITCH. A unison, ideally regarded, is an INTERVAL, being either perfect (as C—C), augmented (C—C#) or double-augmented (C—C^x). The augmented unison, or augmented prime C—C# is often called the chromatic semitone to distinguish it, in JUST INTONATION, from the diatonic semitone C—D^b which only in equal TEMPERAMENT has the same magnitude.

UNIT AIR CONDITIONING, the practice of conditioning air for a single room by equipment placed within the room itself. The equipment for this may consist of a cabinet, in which are sprays of cold water. Built into the cabinet is a fan which circulates the air from the room through the water sprays, which cool it, then delivering it back to the room. By cooling the spray water in a refrigerating unit the air temperature and humidity may be regulated to the condition best suited for comfort. Another type of equipment for air conditioning a single room makes use of unit heaters, through which cooled water or refrigerant is circulated, instead of steam. With this type of equipment only the temperature can be controlled, no regulation of the humidity being possible. The use of ice for cooling the water used in the unit air conditioning equipment is increasing in popularity, particularly where air conditioning is necessary for relatively short intervals. Sometimes air is blown directly over the ice which is placed in cabinets. See also AIR CONDITIONING.

R. B. PR.

UNITARIANISM, the doctrine held by Unitarian Christians, is primarily the affirmation of the unity of

God's nature as distinguished from and in opposition to the belief held by Trinitarians that the Godhead is also triune. Unitarian Christians to-day put less emphasis on the nature of the Deity than on the worth of human nature and the scientific interpretation of all matters of religion. Although there is no authoritative confession of faith, there is practical unity on the basis of "the fatherhood of God, the brotherhood of man, the leadership of Jesus, salvation by character, and the progress of mankind onward and upward forever."

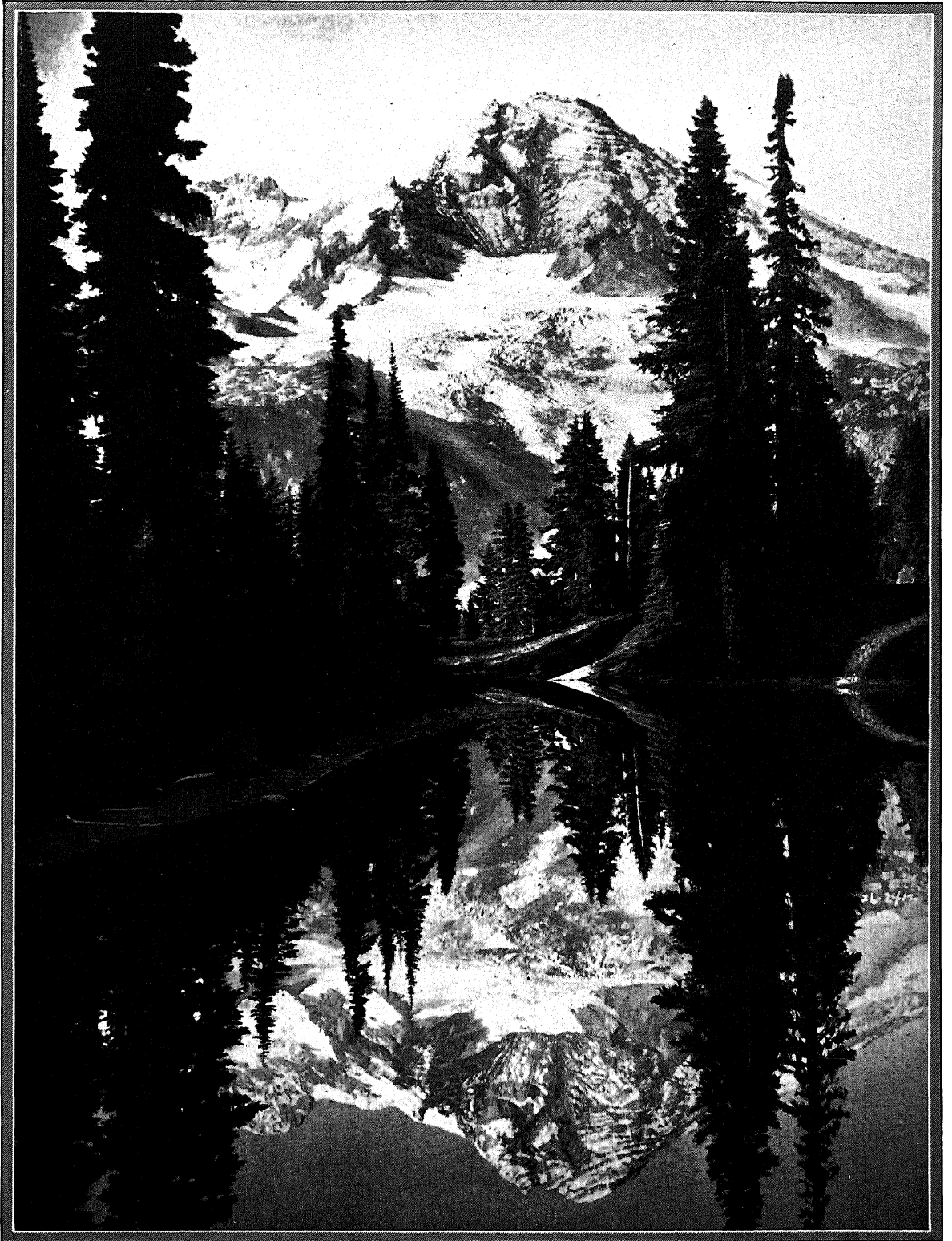
Origin of Doctrine. Unitarians frequently affirm that the early Christians held the same ideas on the unity of the Godhead as themselves; but the first Unitarian church in the world was not organized until 1568, when Bishop Francis David established one at Cluj-Kolozsvár, Transylvania, Hungary, now, and since the war, under the dominion of Rumania. Another view of the origin of Unitarianism traces the doctrine to the teachings of Socinus in Italy in 1546. As a definite form of Christian doctrine it was introduced into England about 1700, and grew in strength in that country throughout the 18th century, until by 1791 there was established the Unitarian Society for Promoting Christian Knowledge and the Practice of Virtue.

The history of many of the churches in England whose members now profess Unitarianism, discloses that the first movement toward this liberal view of Christianity began at the time of the Act of Uniformity, 1662, which deprived some 2,000 clergymen of their parishes. The withdrawal of Theophilus Lindsay (1723-1808) from the Church of England in 1774 to found a Unitarian church in London did much to forward the movement. The present organization in Great Britain, known as the General Assembly of Unitarian and Free Christian Churches, was formed in 1928, by the amalgamation of the British and Foreign Unitarian Association, established in 1825, and the National Conference of Unitarian, Liberal Christian, Free Christian, Presbyterian, and other non-subscribing or kindred congregations, established in 1881. Its headquarters are at Essex House, Essex St., London.

Revised Theology. Although first Unitarianism was an affirmation of biblical Christianity rejecting all creeds, it has, under the leadership of men like James Martineau (1805-1900), J. Hamilton Thom (1808-94) in England, and of William Ellery Channing (1780-1842) and Theodore Parker (1810-60) in the United States, developed into a religion which affirms the scientific method in religion and interprets Christianity primarily as a "way of life." Unitarian churches, except those in Transylvania, which are episcopal in polity, generally are organized as congregational churches.

In the British Isles there were 351 Unitarian churches in 1930-31, England having 275, Ireland 37, Wales 33 and Scotland 6; and 311 ministers served these churches. The number in the United States and Canada organized under the American Unitarian

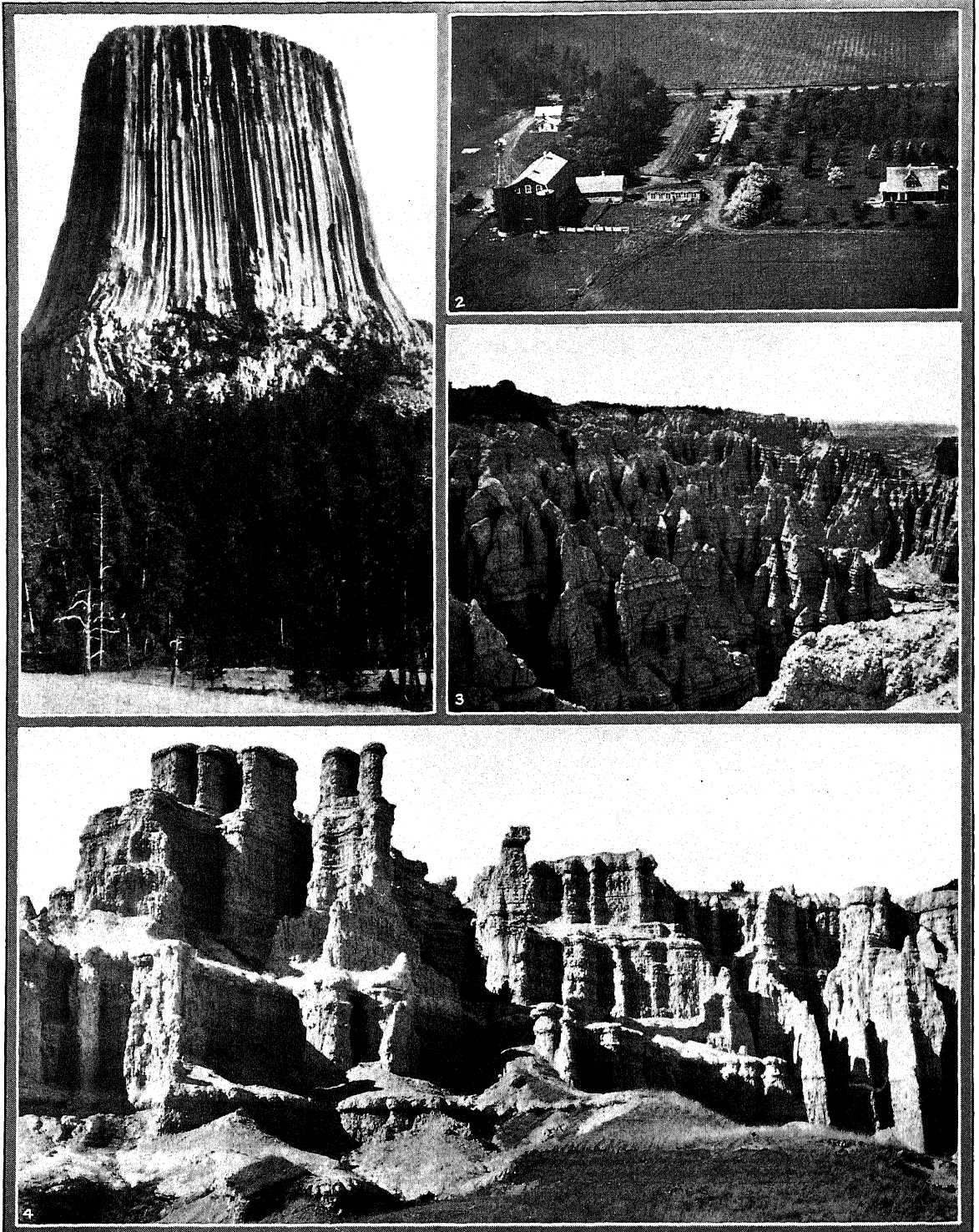
UNITED STATES OF AMERICA



MOUNT RAINIER NATIONAL PARK, WASHINGTON

Mirror Lake, in Indian Henry's Hunting Ground, one of the most beautiful spots in Mount Rainier National Park.

UNITED STATES OF AMERICA



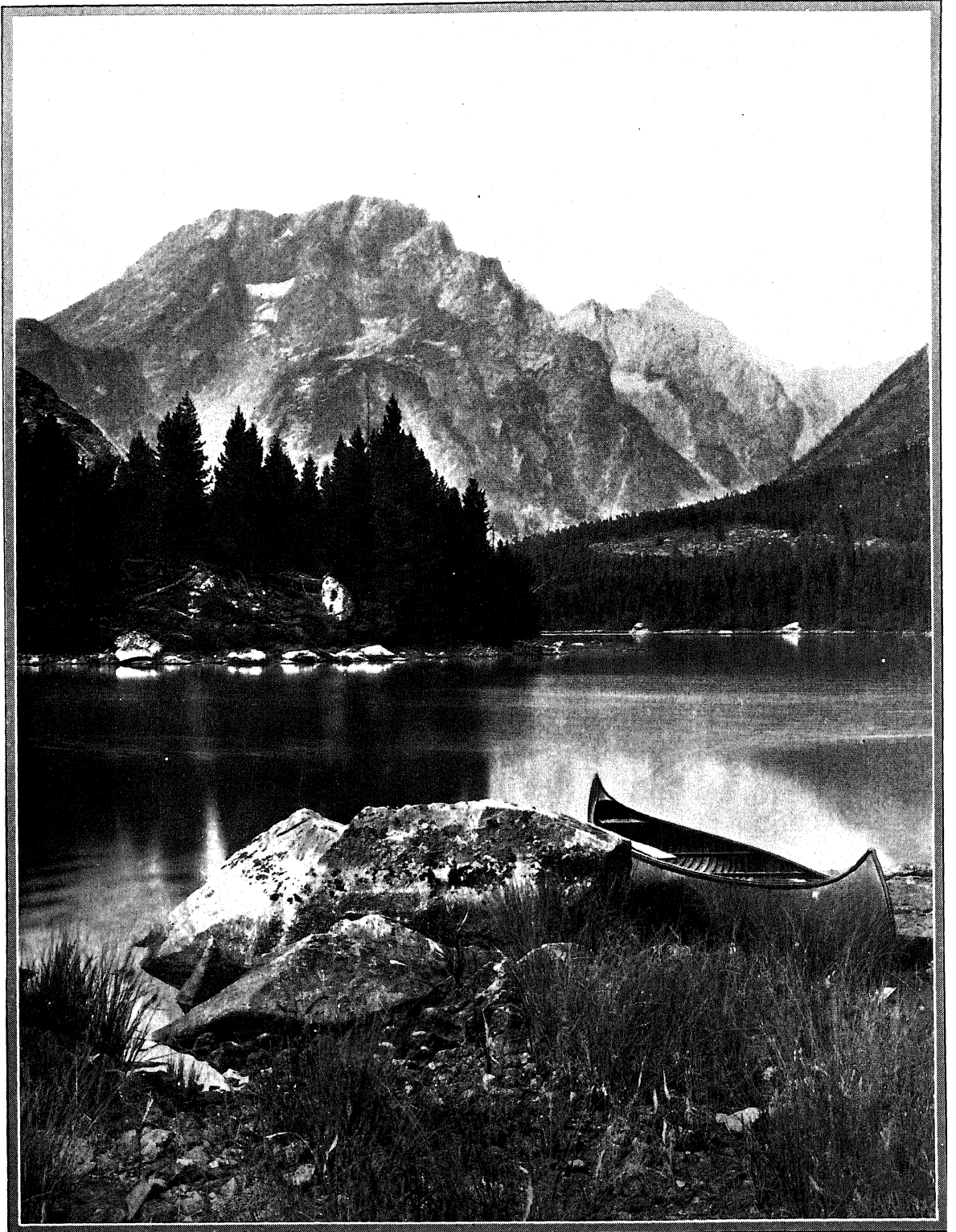
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FARM LAND AND NATURAL FORMATIONS IN THE WESTERN UNITED STATES

1. Devils Tower, a national monument in the Black Hills region of Wyoming; the Tower is a mass of igneous rock rising 600 ft. from a ridge of rock, which in itself rises 600

feet above the Belle Fourche River. 2. Air view of a modern farm in Kingsbury County, South Dakota. 3, 4, Towers and spires of rock in the Bad Lands of South Dakota.

UNITED STATES OF AMERICA

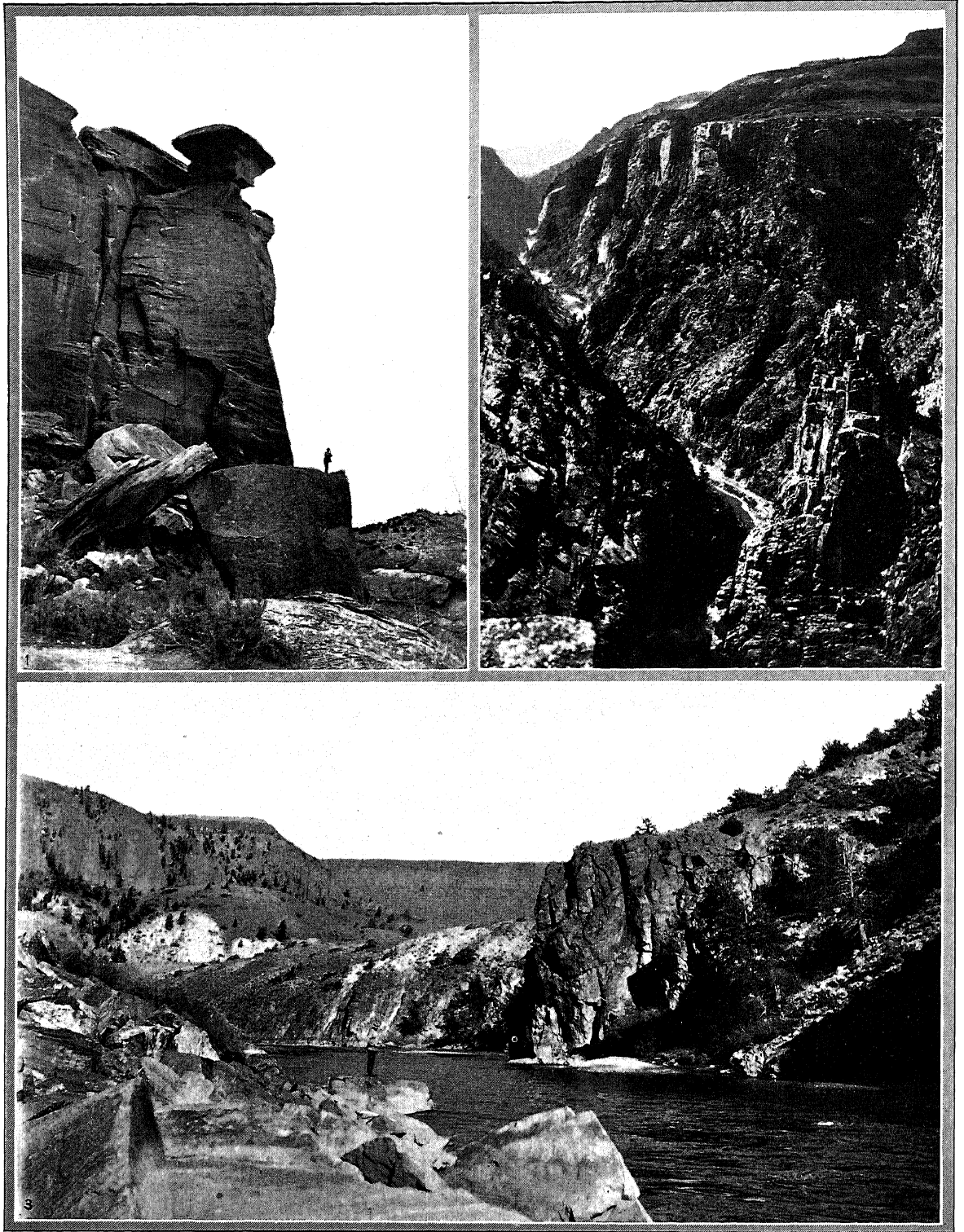


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MT. MORAN, TETON RANGE, WYOMING

Spectacular mountain scenery and good camping grounds characterize Grand Teton National Park.

UNITED STATES OF AMERICA



COURTESY CHAMBER OF COMMERCE, DELTA, COLO.

THE GUNNISON RIVER REGION, WESTERN COLORADO

1. Escalanti Canyon. 2. Black Canyon or Grand Gorge of the Gunnison River, showing the Curicanti Needle. This

massive pinnacle of colored rock tapers at the top, resembling a needle. 3. Fishing in the Gunnison River.

Association, of Boston, Mass., is given below. Apart from scattered churches in South Africa and Australasia, Unitarianism is strongest in Transylvania, Rumania, where 118 churches have settled clergy, and a strong educational system in 30 elementary schools, 2 secondary schools and a theological college. The Transylvanian churches are the oldest Unitarian churches in the world; but since the transfer of the country from Hungary to Rumania, oppression has caused thousands to migrate to Hungary, where new churches are being established. Liberal Christian movements and theistic non-Christian sects of modern viewpoint in Japan, India and other countries of the world, regularly receive the aid and cooperation of the Unitarians in the United States and Great Britain.

The United States. Unitarianism in America evolved out of the rigid theology of early New England Congregationalism into organized church life in the 19th century, fulfilling a liberal spirit which had appeared in many Congregational churches in the latter half of the previous century. Although the first church to declare itself definitely Unitarian was the Episcopal King's Chapel of Boston in 1785, many of the oldest Congregational churches joined the liberal movement during the following 25 years. The election of Henry Ware, a liberal, to the theological chair of Harvard in 1805 hastened the cleavage, and in 1819 an ordination sermon by William Ellery Channing definitely set forth the Unitarian position.

Since 1825, when the American Unitarian Association was formed, the number of Unitarian churches has grown from about 150, the number which came over from orthodox Congregationalism, to about 450 in 1931. Nearly one-half of the Unitarian churches of the United States are in Massachusetts; the order of the next strongest states is as follows: New York, California, Maine, Pennsylvania, Illinois, New Hampshire and Ohio. The Unitarian clergy, numbering to-day about 500, is trained chiefly in the divinity schools of Harvard, Meadville (in Chicago), and Berkeley, Cal. The American Unitarian Association with the various state and national conferences supports various liberal religious movements in foreign lands, especially those in India, Japan and Transylvania, the birthland of Unitarianism. One of the most striking features of American Unitarianism has been the small but select character of its membership. With membership to-day in the United States and Canada of but 60,000 in 376 churches, it has had in its societies a disproportionately large number of the nation's most famous men and women.

UNITED CONFEDERATE VETERANS, a federation of former Confederate soldier and sailor organizations founded in 1889. The society aims to unite all Confederate veterans and to keep alive the ties of friendship existing among those who have shared a common danger. There is a provision to assemble authoritative information for an unbiased history of the Civil War and to gather and preserve relics and mementoes of the war. Widows and orphans of fallen comrades are also extended aid by

the society. The federation is grouped into state divisions and local "camps."

UNITED KINGDOM, a constitutional monarchy, consisting of England, Scotland, Wales and Northern Ireland. When James VI, King of the Scots, acceded to the English crown, he employed the name "Great Britain" to include the kingdoms of England and Scotland. Since their union in 1707, the use of this name for the whole country has been general in official writings, while the more concise form "Britain" is also in use. After the Act of Union of Jan. 1, 1801, between Great Britain and Ireland, the title: "United Kingdom of Great Britain and Ireland" was used until 1922, when 26 counties of Ireland became a coequal member of the British commonwealth of nations, and were named "The Irish Free State." In 1927 by parliamentary enactment it was formally established that the British Parliament shall hereafter be known and styled as "The Parliament of the United Kingdom of Great Britain and Northern Ireland."

UNITED SPANISH WAR VETERANS, a patriotic society formed in 1904, uniting the Society of Spanish American War Veterans, the Society of the Service Men of the Spanish War and the Society of the Hispano-American War. Its main object is to promote the interests of Spanish American War veterans as well as those who served in the Philippine insurrection and Chinese expedition. A further aim is the preservation of friendships formed in common danger.

UNITED STATES OF AMERICA, THE, a federal republic composed of 48 states, is situated entirely within the temperate zone of the continent of North America. The total area of continental United States, based on calculations by the General Land Office, the Geological Survey and the Bureau of the Census, is 3,026,789 sq. mi., of which 53,015 sq. mi. is water. These figures do not include the water area of the Great Lakes, the Atlantic Ocean, the Gulf of Mexico, the Pacific Ocean and the Strait of Juan de Fuca, which is under the jurisdiction of the United States. The average or mean area of the 48 states is 63,057 sq. mi., or approximately the same as the combined areas of New York, Massachusetts, Rhode Island and Connecticut. Texas, with a total area of 265,896 sq. mi., is the largest state in the Union; Rhode Island, with a total area of 1,248 sq. mi., is the smallest.

The principal elements of the northern or Canadian boundary are the 49th parallel east from Point Roberts on the Strait of Georgia to the Lake of the Woods; an arbitrary line through Lakes Superior, Huron, Erie and Ontario; the St. Lawrence River; and an arbitrary line forming the northern boundary of Vermont, New Hampshire and Maine, ending at the Atlantic Ocean in Passamaquoddy Bay. On the east the United States is bounded by the Atlantic Ocean; on the west by the Pacific. The southern boundary consists of the Gulf of Mexico, the Rio Grande and an arbitrary line, approximately in 32° N. lat., from El Paso west across the Cordilleras to the Pacific at the town of Imperial

Beach, Cal. The most northerly point is reached in the Lake of the Woods, Minn., which extends to $49^{\circ} 23' 04.5''$ N. lat. at $95^{\circ} 09' 11.6''$ W. long. The most southerly point of continental United States is Cape Sable, Fla., $25^{\circ} 07'$ N. lat., $81^{\circ} 05'$ W. long; the extreme southern point of Texas is in $25^{\circ} 50'$ N. lat., $97^{\circ} 24'$ W. long. West Quoddy Head, a cape near Eastport, Me., $66^{\circ} 57'$ W. long., $44^{\circ} 49'$ N. lat., forms the most easterly extension; the westernmost point is Cape Alava, Wash., which extends into the Pacific Ocean to $124^{\circ} 44'$ W. long., in $48^{\circ} 10'$ N. lat. The greatest Atlantic to Pacific distance is 2,807 mi., measured from West Quoddy Head west along the parallel to the Pacific Ocean to a point near the Oregon cape known as Yaquina Head. The shortest Atlantic to Pacific distance is from a point 10 mi. south of Brunswick, Ga., to a point 12 mi. south of San Diego, Cal., measuring 2,088 statute mi. From the south point of Texas due north to the 49th parallel the distance is 1,598 mi. The two points farthest apart in the United States are Cape Flattery, Wash., and a point on the Florida coast south of Miami, 2,835 mi. apart.

The geographical center of continental United States is located in the eastern part of Smith Co., Kans., $39^{\circ} 50'$ N. lat., $98^{\circ} 35'$ W. long. The highest point in the United States exclusive of Alaska is the peak of Mt. Whitney, in Inyo and Tulare counties, Cal., altitude 14,496 ft.; the lowest point is the bottom of Death Valley in Inyo Co., Cal., 276 ft. below sea level. As given by the United States Coast and Geodetic Survey, the lengths of the tidal coast lines of the mainland of the continental United States in statute miles (measured in steps of one mile radius) are: Atlantic Ocean, 5,565 mi.; Gulf of Mexico, 3,641 mi.; Pacific Ocean, 2,730 mi.; total, 11,936 mi. According to the United States Geological Survey the length of the Mexican boundary from the Gulf of Mexico to the Pacific Ocean is approximately 2,013 mi. The length of the northern boundary, including the water boundary through the Great Lakes and the St. Lawrence, is 3,987 mi., making a grand total of land and water boundaries of 17,936 mi.

Surface Features. The principal physical features of the United States are the Appalachian mountain system in the east, which slopes off in the coastal plain toward the Atlantic Ocean and the Gulf of Mexico; the Cordilleran system of mountains in the west, and the great central valley, dominated by the Mississippi-Missouri rivers and the Great Lakes lying between the two mountain systems.

East of the Appalachians lies the Piedmont province, a plateau extending from Wetumpka and Clanton, Ala., to New York City. An ancient shore line which descends more or less abruptly to the coastal plain marks the eastern boundary of this plateau, and this "Fall Line" is the site of many manufacturing cities which utilize the natural power supplied by numerous rivers having their sources in the Appalachian Mts. and flowing across the coastal plain into the Atlantic. The northern portion of the Atlantic coastal plain is narrow and is indented by many excellent harbors, as

those of New York, Portland and Boston, and Chesapeake and Delaware bays. It is also fringed with islands, of which Long Island is the largest. From New Jersey to North Carolina the shore is largely lined with sand reefs, of which capes Hatteras, Fear and Lookout are outstanding examples. The width of the coastal plain increases from north to south, reaching a maximum width of approximately 580 mi. between Macon, Ga., on the edge of the Piedmont, and the southern tip of Florida. It continues in the rich agricultural plains bordering on the Gulf of Mexico.

The Appalachians are an old and worn mountain system extending in a south-southwest direction from Newfoundland to Alabama, where they merge into the coastal plain. They consist chiefly of parallel mountain ranges worn down to even crests and broad uplands and separated by wide valleys. The depressions formed by the Hudson River and Lake Champlain and by the Mohawk River divide them into three main divisions. The highest elevations are attained in the White Mts. of New Hampshire and in the Black Mts. of North Carolina, which are the only ranges retaining a distinctly conical or peak formation.

Other principal ranges are the Green Mts. of Vermont, the Catskills of southeastern New York, the Alleghenies of Pennsylvania, Maryland, Virginia and West Virginia, and the Smoky Mts. of North Carolina and Tennessee. Mt. Mitchell (6,684 ft. elevation) in the Black Mts. of North Carolina is the highest peak in the Appalachian system. The Adirondack Mts. of northern New York and the highlands of northern Michigan and Wisconsin and northeastern Minnesota are outlying spurs of the Laurentian region of Canada. The Hudson River, furnishing the only deep water passage through the Atlantic Highlands, has been a powerful factor in giving New York City its predominance among Atlantic seaports.

Approximately one-half of the area of the United States is comprised in the Great Central Valley of the Mississippi-Missouri rivers and the Great Lakes. With the exception of the Ozark Mts. of southern Missouri, northwestern Arkansas and eastern Oklahoma, which attain an altitude of 2,800 ft. in the Blue and the Magazine mountains in Arkansas, the entire valley is a low prairie region rising gradually from the coast plains of the Gulf of Mexico northward to the Great Lakes. That portion of the region extending from the Appalachians to approximately the 100th meridian forms the most important agricultural area in the entire world. West of the 100th meridian the prairies gradually merge into the Great Plains, which reach an altitude of between 5,000 and 6,000 ft. at the base of the Rockies. These plains extend from central Texas north into Canada, having their greatest width north of the 35th parallel. They are an important stock grazing region.

The Cordilleran region of the United States includes the complex of mountain ranges, subordinate mountain chains and the intervening basins extending from the eastern edge of the Rocky Mts., where it terminates rather abruptly in the Great Plains, to the western

extremity of the coast ranges which come practically to the shores of the Pacific. The greatest east to west width of the vast Cordilleran system is approximately 1,000 mi. and is reached at the 40th parallel. In a north and south direction it extends within the United States from the Canadian to the Mexican boundaries. The Rocky Mountain system is located in Colorado, Wyoming, Montana, Idaho, Utah and New Mexico. It has large areas with an elevation of over 10,000 ft. and more than 30 peaks reaching an altitude of over 14,000 ft. Among the well-known summits are Pikes Peak, Longs Peak, Grays Peak and Mountain of the Holy Cross. Mt. Elbert (14,420 ft. elevation) is the highest point in the Rockies.

The Colorado plateaus, extending south of the Uinta range in Utah, New Mexico and Arizona, are a high and arid region lying at an altitude of over 6,000 ft. Through these plateaus the Colorado River and its branches have cut canyons from 3,000 to 5,000 ft. deep, of which the most famous is the Grand Canyon of the Colorado. Large areas in the region are covered with ancient lava flows. Between the Colorado plateaus and the Great Basin lies the Wasatch Range, rising to heights of 7,000 and 9,000 ft. The Great Basin covers most of Nevada and parts of Utah, Oregon, Idaho, California and Wyoming and includes the Mohave, Carson and Great Salt Lake deserts. It has no outlet to the ocean and contains the driest regions in the United States. There are many short mountain ranges within the Basin, all extending in a north and south direction. Some are sufficiently high to have trees on their summits, but the majority are stark and barren. Great Salt Lake is a meager remnant of one of the large bodies of water which occupied the major portion of the region during Pleistocene times. North of the Great Basin and between the Rockies and the Cascades is the Columbia plateau, a region built up of vast lava sheets and now drained by the Columbia and Snake rivers.

The Sierra Nevada Range of California runs practically parallel to the Pacific coast. It is famous for the magnificence and grandeur of its scenery and contains Mt. Whitney (14,496 ft. elevation), the highest mountain in the United States proper. The Cascade Mts. of Washington and Oregon are a continuation of the Sierra Nevada. They are characterized by great volcanic cones, of which Mounts Rainier and Hood are outstanding, and have extensive snow fields and glaciers. Between these ranges and the Coast Ranges are several narrow and extremely fertile valleys: the Sacramento and San Joaquin valleys of California, the Willamette Valley of Oregon, and the Puget Sound Valley of Washington. The Coast Ranges are of moderate height and frequently end abruptly at the ocean's edge in rugged cliffs and headlands. San Francisco Bay and Puget Sound are outstanding natural harbors on the Pacific coast.

The principal river systems of the United States are the Mississippi, which with the 527,000 sq. mi. drained by the Missouri has a total drainage area of 1,238,000 sq. mi.; the Columbia River, which drains 259,000 sq.

mi.; the Colorado, 244,000 sq. mi., and the Rio Grande, which drains an area of 248,000 sq. mi. *See also* APPALACHIAN MOUNTAINS; CORDILLERA; GREAT PLAINS; ALLEGHENY MOUNTAINS; ROCKY MOUNTAINS; SIERRA NEVADA; GREAT LAKES; HUDSON RIVER; COLORADO RIVER; COLUMBIA RIVER; MISSISSIPPI RIVER, and articles on other mountains, lakes and rivers.

Climate. The United States is situated entirely within the North Temperate Zone. Its climatic areas have been divided into 106 sections by the United States Weather Bureau, which for convenience are grouped under Eastern, Gulf, Plains, Plateau and Pacific provinces. The Eastern Province comprises roughly all sections east of the 100th meridian north of the 32nd parallel. Seasons throughout this province are strongly contrasted, and the temperature ranges between January and July are great. In the northern part the mean annual temperature is approximately 40° and increases toward the south to slightly less than 60°, or about 2° for each degree of latitude. In all sections the annual rainfall exceeds 20 in., and approximately one-half receives more than 40 in.

The Gulf Province, comprising the regions bordering on the Gulf of Mexico and the Atlantic Ocean south of approximately the 32nd parallel, has a composite mean annual temperature of almost 70°. Portions of the seacoast of Louisiana, Mississippi, Alabama and Florida have an annual rainfall exceeding 60 in. The Plains Province extends roughly from the 100th meridian west to the Continental Divide. Its climate differs from that of the Eastern Province in rainfall rather than in temperature. At the 100th meridian the annual rainfall is approximately 20 in. This decreases toward the west with the increase in altitude, and at the eastern edge of the Rockies the annual rainfall is about 10 in. Oklahoma and most of Texas have an average annual precipitation of about 25 in.

Between the Continental Divide and the Sierra Nevada and Cascade Mts. is the desert region of North America, known to the climatologist as the Plateau Province. It is a region having the minimum of cloudiness for the United States and the minimum relative humidity. The greatest daily range of temperature also occurs in this region, where rises of from close to the freezing point to 80 and even 90 degrees during the month of July are on record.

The outstanding feature of the climate of the Pacific Province is its diversity, ranging from subtropical and desert regions in the south to snow and glacier clad mountains in the north. The mean annual temperature of the Pacific coast is everywhere higher than that of corresponding regions on the Atlantic, though the summers are as a whole several degrees cooler. The rainfall varies from less than 10 in. in the interior portions of southern and central California to over 120 in., the record for the United States, in the Olympic Mts. of northwestern Washington. The higher slopes of the Cascade Range and small portions of the northern Sierra Nevada and the Coast Range have an annual rainfall of 80 in.

Temperatures of above 100° are frequent in the

southwest from Texas to California, and winter temperatures of 40° below zero are reached almost every winter in North Dakota and Montana. The record high for the United States, 134° F., was recorded at Greenland Ranch, Death Valley, Cal., July 10, 1913. Temperatures below 60° F. have been recorded in Montana.

In midwinter the prevailing winds are westerly over the entire country. In summer they are westerly on the Pacific coast but generally southerly east of the Rockies.

Soil. The soils of the United States may be divided into two major groups, each including many subgroups. In general the dividing line between the two major groups runs irregularly from the Canadian border southward through western Minnesota, eastern Nebraska and Kansas, central Oklahoma and central Texas to the Gulf of Mexico in the vicinity of San Antonio Bay. Soils east of this line are those in which lime carbonate has not accumulated, and in the true soil layer such lime carbonate as may originally have been present in the parent material has been entirely removed by the time the soil is mature or well developed.

The western group includes all soils which, after having become mature or well developed, have acquired, at some depth in their vertical section, a layer in which the proportion of accumulated lime carbonate is greater than in the layers of soil above it or in those of the parent material below. The rich agricultural prairie regions of Illinois, Minnesota, Iowa, Missouri, eastern Kansas and Nebraska and part of Oklahoma have a thick top soil of a dark brown to black color containing a high percentage of organic matter, and in their virgin state are covered with luxuriant grasses.

Soils of the Great Lakes region and of the high plateaus and mountain regions of the northeastern states and lower elevations in northern New England are usually shallow. In their virgin condition they have a cover of decomposed leaves, twigs, grass and other vegetable matter and ordinarily bear coniferous forests. The soils of the southeastern part of the United States, extending from Virginia south to the Gulf of Mexico and southwest to central Texas, are classified as yellow and red soils.

In the western soils there is a gradual decrease in percentage of organic matter from north to south and from east to west. From north to south there is also an increase in intensity of oxidation resulting in an increasing redness of the soil and in the extreme south the calcium carbonate layer becomes indurated into limestone.

Flora. Except small areas above timber line on the higher mountains, which possess an alpine flora, and narrow fringes in the extreme south, which have a subtropical flora, the native vegetation of the United States is made up of plants characteristic of north temperate regions. In general the flora, estimated to comprise some 12,000 species of flowering plants, bears marked resemblances to that of Europe and north central Asia, with large densely forested areas, great grassy

plains, extensive semiarid plateaus and some almost rainless deserts.

Although a limited number of native plants are distributed widely throughout the country, there is, on the whole, a notable difference between the plants found east of the western border of the Great Plains and those occurring from the Rocky Mountains to the Pacific coast. Moreover, in point of species, the southern and western parts possess a richer and more varied plant population than the northern and eastern districts.

To illustrate: *Gray's New Manual of Botany*, 1908, covering the central and northeastern states, an area of approximately 800,000 sq. mi., describes 4,079 native species, but W. L. Jepson's *Manual of the Flowering Plants of California*, 1925, covering an area of only 160,000 sq. mi., enumerates 3,727 native species, of which 1,416 or 38% are found wild only in California. P. A. Rydberg's *Flora of the Prairies and Plains*, 1932, covering a region in central North America of some 800,000 sq. mi., describes 3,988 species, while J. K. Small's *Flora of the Southeastern United States*, 1913, embracing a region of about 600,000 sq. mi. extending from Florida and the Carolinas westward through eastern Texas, contains descriptions of more than 6,300 species. The arid areas of the Great Basin possess a highly diversified vegetation, as shown by Ivar Tidestrom's *Flora of Utah and Nevada*, 1925, which describes some 3,700 species occurring in an area of about 200,000 sq. mi. It should be remembered that each of these regional floras contains numerous overlapping species, yet these enumerations clearly indicate the relative diversity of the native plants in the major regions of the country. See also NORTH AMERICA: Flora.

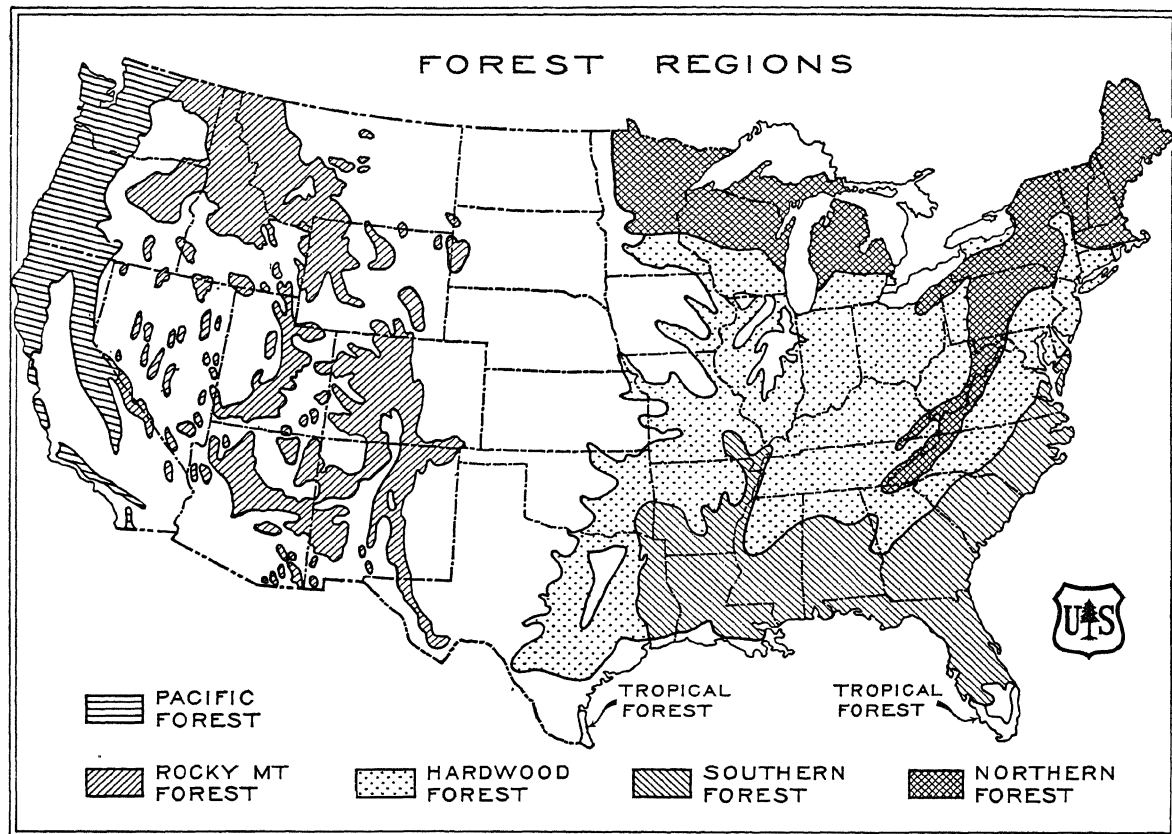
Fauna. The animal life of the United States, like the plant life, consists mainly of forms characteristic of north temperate latitudes throughout the world. Many of its distinctive types, as the bison, moose, and wapiti, have their counterparts among the animals of Europe and north central Asia. With the exception of certain exclusively arctic and boreal species, as the polar bear, muskox and caribou, and a limited number of subtropical forms, as the jaguar, found from Mexico southward, practically all of the larger animals occurring on the continent of North America are found within the boundaries of the United States. Because of the foregoing the reader is referred to the article NORTH AMERICA, section Fauna, for a fuller discussion. See also the articles on various well-known American mammals, as BISON, MOOSE, DEER, WAPITI, PRONGHORN, BIGHORN, BEAR and PUMA, and articles on numerous birds, reptiles, amphibians, fishes, insects, mollusks, crustaceans and other important groups.

Forests. The original forested area of the United States, exclusive of Alaska and the island possessions, is estimated at 822,238,000 ac. Approximately 470,000,000 ac. of forest land remain, of which about 138,000,000 ac. are virgin stands; 115,000,000 ac. are culled and second growth timber large enough to be of commercial value; 136,000,000 ac. are partially cov-

ered with timber of non-commercial size, and 81,000,000 ac. are burnt or cut-over lands of practically no value. According to the most generous estimates, only about two-fifths or 2,200,000,000 board feet of the original growths of merchantable timber remained standing in 1931. Lumber companies and other large private owners own approximately one-half of the forest land. One-third is in small woodland areas on farms, and about one-sixth of the forested lands containing approximately one-fifth of the total acreage of standing timber, is comprised in the 140 National Forests, exclusive of Alaska. A large portion of these

practically all of Nevada, western Utah, southeastern Oregon, part of eastern and southeastern California, part of southern Idaho and a small section of Wyoming, trees of forest size are found only in the highest altitudes.

Some two-fifths of the total amount of standing timber is now located east of the Great Plains, the largest forests being found in northern New England, northeastern New York, portions of the Lake States, central Pennsylvania and the Appalachian region of the South Atlantic and the Gulf States. In other sections forests consist chiefly in small tracts on farms,



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publicly owned timber regions of the National Forests is on high mountain slopes and inaccessible for lumbering purposes.

The entire area of the United States east of the Great Plains was originally a continuous forest broken only by comparatively small natural openings or clearings and certain swampy districts. In the Great Plains region extending from the Mississippi River to the foothills of the Rocky Mountains, trees, with but few exceptions, were found only along the water courses. The Great Basin lying west of the Rockies and extending to the Sierra Nevada and Cascade ranges is the one region in the United States which can be characterized as treeless. In this region, which includes

these woodlots comprising from 10% to 60% of the total farm area of the various states. The eastern area may be divided into three regions (see Plate): Northern, Central Hardwood and Southern forests, according to the kind of trees and their relative abundance. A small tropical forest area is found on the southern tip of the Florida Peninsula. The Southern forests comprise pine lands with longleaf, shortleaf, loblolly and slash pines as the principal trees; also alluvial bottoms and swamps with cypress and gums in predominant number. The yellow-pine forests of Georgia, Alabama and Mississippi constitute the sole remaining source of extensive lumber timber production in the eastern United States. Oak, hickory and

gums are the chief trees of the hardwood or deciduous region. The Northern forest is largely coniferous with hardwoods increasing in proportion in the Appalachian region. In contrast to the Western forests where a single kind of tree often occupies large areas, species in the eastern forests are widely intermingled, and to find even a small area occupied exclusively by but one species is exceptional. Diversity of forest species decreases from south to north.

The Western forests comprise the Rocky Mountain and the Pacific Coast forests. (See Plate.) The Rocky Mountain forest is essentially coniferous and consists of large tracts of timber as well as relatively small scattered tracts on ridges and higher elevations. These forests have not the economic importance of either the Pacific Coast or Eastern stands. The Pacific Coast forests cover western Washington and Oregon and most of the northern part of California with the exception of Sacramento Valley. The densest forests in the United States are located in Washington and Oregon. These forests are composed of giant conifers, chiefly Douglas fir, western hemlock, noble, silver and white firs, and western red cedar. In the southern or California portion the trees of the timber lands are chiefly western yellow and Jeffrey pines, sugar pine, redwood and bigtree surrounded by narrow margins of low broadleaf tree forest or chaparral. One-half of the total standing timber in the United States is found in the Pacific Coast forests. Approximately three-fifths is west of the Great Plains.

Alaska has two types of forested regions. Along the southeastern coast the general forest type of Washington and British Columbia is continued, and the trees, principally western hemlock and Sitka spruce, attain great size. The Tongass and Chugach National Forests, with a combined area of over 21,000,000 ac., contain the best stands of this region. The interior forests, covering an estimated area of more than 80,000,000 ac., are located chiefly within the drainage basins of the Yukon and Kuskokwim rivers. Although the stands in this forest region are dense, white spruce is the only tree growing to saw-timber size. *See also* NATIONAL FORESTS.

Agriculture. During Colonial times and throughout most of the first century of national life agriculture was the overwhelmingly predominant industry. Notwithstanding the immense development of manufactures since the Civil War and especially since 1900, agriculture still furnishes employment to a much larger number of persons than any other industry. Despite the enormous increase in the number and size of cities, more than two-fifths (43.8%) of the total population in 1930 lived upon farms and was engaged chiefly in agricultural pursuits.

Because of great extent, variety and fertility of soil and wide range of climatic conditions, almost every important staple crop can be grown in the United States. The Mississippi Valley comprises one of the largest and most highly productive agricultural areas in the world. Added to this are the rich valleys of other rivers emptying into the Gulf of Mexico, various

areas of high fertility east of the Alleghenies, and extensive tracts in the western states made exceedingly productive by irrigation.

No other country for which statistics of production are available yields crops of greater value than the United States. It stands first in the production of the great staples, wheat, corn, cotton, and tobacco; is a principal producer of many other important crops, as oats, barley, potatoes, sugar beets and alfalfa; and leads the world in the commercial production of numerous fruits, as apples, peaches, and strawberries, and also in the growing of market vegetables, especially tomatoes, lettuce, muskmelons and sweet corn.

In 1930 986,771,016 ac. or 51.8% of the entire land area was in farms, 6,288,648 in number, with an average size per farm of 156.9 ac. and an average value per acre of \$58.01, or an average value per farm of \$9,103. Of the farm area 413,235,890 ac. was crop land; 464,154,524 ac., pasture land; and 64,623,825 ac., woodland. The total value of farm property was \$57,245,544,269, of which \$47,879,838,358 was represented by land and buildings; \$3,301,654,481, by implements and machinery; and \$6,064,051,430, by domestic animals. The decrease from 1920 in the total value of farm property was \$20,678,107,330 or 26.5%.

According to the Census of 1930 the United States produced in 1929 field crops to the value of \$8,080,072,011. Of this total cereals and other grains and seeds comprised 42.1%; hay and forage, 14.7%; cotton, tobacco and other field crops, 22.8%; market vegetables, 9.6%; and fruits and nuts, 8.1%. Statistics regarding the chief field crops, the aggregate value of which was about three-fourths of that of all crops, are set forth in the following table:

PRINCIPAL FIELD CROPS, 1929

<i>Crop</i>	<i>No. farms reporting</i>	<i>Acreage</i>	<i>Production</i>
Barley	542,710	12,890,772	263,589,965 bu.
Corn	4,148,791	83,161,523	2,130,751,782 bu.
Cotton	1,986,726	43,227,488	14,574,405 bales
Cottonseed			6,914,866 tons
Flaxseed	87,002	2,965,635	15,046,097 bu.
Hay, all		67,827,899	85,280,764 tons
Oats	1,518,893	33,466,025	992,746,912 bu.
Potatoes	2,982,677	2,944,082	322,415,914 bu.
Rice	8,945	740,588	33,468,983 bu.
Rye	175,184	3,032,802	34,302,824 bu.
Sugar beets ...	35,155	643,797	7,134,987 tons
Sweet potatoes..	1,126,423	649,847	65,193,091 bu.
Tobacco	432,975	1,888,365	1,456,510,003 lbs.
Wheat	1,208,368	61,999,908	800,648,955 bu.

The most highly productive agricultural states lie in the Mississippi Valley or west of it. Four states, namely, Texas, California, Iowa and Illinois, yielded in 1929 crops valued at upwards of two billion dollars, or practically one-fourth of the total crop production of the United States. Statistics regarding the 12 leading states, which together produced 51.2% of the agricultural output of the nation, are shown in the accompanying tabulations:

LEADING AGRICULTURAL STATES, 1929

<i>State</i>	<i>No. Farms</i>	<i>Value of Products \$</i>	<i>Chief Crops</i>
Texas	495,489	617,859,392	Cotton, cereals
California	135,676	537,478,777	Fruits, vegetables
Iowa	214,928	466,431,781	Corn, oats, hay
Illinois	214,497	387,220,212	Corn, oats, hay
Minnesota	185,255	309,874,348	Cereals, hay, vegetables
Kansas	166,042	299,152,090	Wheat, corn, hay
Nebraska	129,458	299,127,260	Corn, oats, wheat, hay
Mississippi	312,663	270,501,649	Cotton, cereals
North Carolina	279,708	253,844,532	Tobacco, cotton
Oklahoma	203,866	245,560,631	Cotton, cereals
Ohio	219,296	232,768,211	Cereals, hay, vegetables
Georgia	255,598	232,422,508	Cotton, cereals

Additional details in regard to farms, number, acreage and value, and crops, yield and value, are given in the section Agriculture in the articles on the various states.

Irrigation. In numerous arid and semiarid districts in the western half of the United States, where the average rainfall during the growing season is greatly deficient, irrigation has been established to insure the production of field crops. Irrigation enterprises have been developed on a large scale in the more elevated parts of the Great Plains, in the Rocky Mountain region, in the Great Basin region, and in the Pacific Coast states. Irrigation is utilized also in certain sections of Arkansas, Louisiana and Texas in connection with the growing of rice.

Although the Spanish-Mexican pioneers in the Southwest practiced irrigation to a limited extent, the early Mormon settlers in Utah were the first to develop irrigation in the United States on a substantial scale. Within 15 years from their arrival in the valley of Great Salt Lake in 1847 they placed upwards of 100,000 ac. under irrigation. Mormon colonies in other western states established irrigation at very early dates, as at San Bernardino, California, in 1851. Following the completion of transcontinental railways, which opened up the West for settlement, rapid development of irrigation occurred, especially between 1880 and 1900.

The Census of 1930 gives separate detailed reports regarding irrigation developments and operations in 19 states, the list embracing all those situated west of the Mississippi River except Minnesota, Iowa and Missouri.

In some mountain and Pacific states irrigation is applied to only a small percentage of the total crop land, as in Washington 8%, Montana 14%, Oregon 21.5% and New Mexico 29%, or is utilized locally for the production of special crops. In certain other states from two- to three-fifths of the total crop land is irrigated, as in Colorado 40%, Idaho 40%, Wyoming 54% and California 56%. But in the central and southern parts of the Great Basin crop production depends almost exclusively upon irrigation, the proportion of crop land irrigated being 89% in Arizona,

90% in Utah and 98% in Nevada. In Kansas, Nebraska and South Dakota irrigation, though of local importance, is a minor factor in agriculture; in North Dakota and Oklahoma the area irrigated is insignificant.

California leads all other states as regards total acreage irrigated, value of irrigated farms and value of crops produced on irrigated land. Next in importance are Colorado and Idaho, with Utah, Montana, Washington, Texas, Oregon, Arizona and Wyoming ranking next usually in the order named.

In point of area irrigated the six leading states, which together contained about three-fourths (74.1%) of the total irrigated acreage of the United States, were California 24.3%, Colorado 17.4%, Idaho 11.2%, Montana, 8.1%, Utah 6.8%, and Wyoming 6.3%. In point of value of irrigated farms, the six leading states, which collectively contained 82.6% of the total value of all irrigated farms in the country, were California 52.7%, Colorado 8.1%, Idaho 6.2%, Utah 4.3%, Washington 4.2%, and Montana 4.1%.

According to the Census of 1930 the total number of irrigated farms for the 19 states enumerated was 265,147, with an aggregate area of 78,339,222 ac., of which 19,547,544 ac. were irrigated. Including land and buildings the value of all irrigated farms was \$4,629,781,819, or an average of \$59.10 per ac. The total investment in irrigation enterprises to 1930 was \$1,032,755,590 and the average cost of maintenance and operation for the year 1929 was \$2.77 per ac. Additional details are set forth in the sections on Irrigation in the articles on the various western states. See also IRRIGATION.

Animal Industry. From the time of the earliest settlements to the present day the raising of livestock has been of prime importance in the economic life of the country. Horses for quick transportation, cattle for use as heavy draft animals and as a source of food and leather, and sheep to provide wool for homespun fabrics were indispensable to the Colonial pioneer. When grains for feeding, as corn and barley, became available, fattened swine contributed greatly to the frontiersman's food supply. As agriculture became more widely established stock raising became an inseparable adjunct to crop growing, although cattle rearing sometimes preceded grain farming, as in Texas and other states containing extensive natural pasture areas.

With the settlement of the corn belt in the central Mississippi Valley, stock raising, especially the rearing of cattle and hogs, became an industry of international importance, a large proportion of the immense grain crop being used in the production of beef and pork. Following the establishment, about 1875, of export trade in animal food products American packed meats were for many years leading staples of foreign commerce, rising by 1900 to approximately one-third of the world's supply. But, with increasing meat production in Australia and Argentina, with decreasing numbers of cattle reared for slaughtering, owing to the utilization of western grazing lands for crop production, and

with the marked expansion in domestic consumption resulting from the rapid growth of American cities, meat exports substantially declined so that by 1914 they were considerably below meat imports. There was, however, a pronounced temporary revival of export production during the World War. Since that period the trend toward greater home consumption and smaller exports has been resumed.

The outstanding feature in the progress of animal industry in the ten-year period 1919-29 was the rapid development of the dairy and poultry industries, the quantity of milk produced increasing 41.6% and the number of chicken eggs produced, 62.6%. Despite the decline in prices there was an increase of 22.7% in the total value of dairy products sold, and of 20.6% in the total value of chicken eggs sold. In wool growing the increase during the decade was 21.3% in the number of sheep shorn and 29.8% in amount of wool produced. There was also an increase of about 40% in the number of goats reared, chiefly Angora, and of nearly 90% in the amount of mohair clipped, produced chiefly in the southwestern states.

Although during the decade 1920-30 the number of cattle on farms declined 18.6% and the number of swine on farms declined 44.7% from the high peak attained just after the World War, the total value of all livestock products (exclusive of animals sold or slaughtered), increased, despite the fall in prices, from \$2,666,943,673 for 1919 to \$3,307,324,942 for 1929, or 19.3%, due largely to the expansion in the dairy and poultry production. The most significant change during this period was the decline of about 32% in the number and about 49% in the value of horses on farms, caused by the increasing use of automobiles, motor trucks, tractors and other motor driven machinery.

LIVESTOCK ON FARMS, 1920-1930

<i>Animal</i>		1920 (Jan. 1)	1930 (April 1)
Horses	number	19,767,161	13,510,839
	value \$	1,782,077,487	905,881,187
Mules	number	5,432,391	5,375,017
	value \$	779,294,411	442,766,112
Cattle	number	66,639,556	63,895,826
	value \$	3,651,521,490	3,303,987,602
Dairy cows	number	19,675,297	20,498,955
Swine	number	59,346,409	56,287,920
	value \$	988,582,380	641,098,909
Sheep	number	35,033,516	56,975,084
	value \$	395,401,286	413,859,962
Goats	number	3,458,925	4,821,294
	value \$	17,565,363	19,320,072
Chickens	number	359,537,127	378,878,281
	value \$	373,394,057	321,624,749
Bees (hives)	number	3,467,396	3,107,755
	value \$	16,841,353	13,632,266

Livestock raising is centered in the areas of extensive grain and hay production, combined with abundance of pasture. Statistics concerning the ten leading states, which, according to the Census of 1930, contained in point of value 50% of all the livestock in the United States, are presented in the following table:

LIVESTOCK, LEADING STATES, 1930

<i>State</i>	<i>Rank</i>	<i>Total value \$</i>	<i>Value of Livestock Products \$ 1929 *</i>
Iowa	1	497,462,626	180,781,458
Texas	2	454,721,904	135,723,216
Wisconsin	3	307,805,142	270,064,411
Minnesota	4	301,263,153	172,351,822
Illinois	5	290,199,219	156,678,235
Nebraska	6	288,770,142	77,168,858
Missouri	7	258,660,903	129,841,794
Kansas	8	246,707,899	101,686,471
New York	9	222,250,942	232,225,134
Ohio	10	216,730,141	158,602,986

* Exclusive of the value of domestic animals sold or slaughtered.

LIVESTOCK PRODUCTS 1919-1929

<i>Product</i>	1919	1929
DAIRY PRODUCTS:		
Milk produced	gallons . . . 7,805,143,792	11,052,023,357
Whole milk sold	gallons . . . 2,529,331,413	4,455,638,767
Whole milk sold	value \$. . . 717,380,222	1,036,650,035
Butter sold	pounds . . . 207,859,564	135,045,358
" " "	value \$. . . 106,973,742	56,056,376
Cream sold as butterfat	pounds . . . 532,244,072	1,179,905,874
Cream sold as butterfat	value \$. . . 303,552,156	538,795,009
Cream sold not as butterfat	gallons . . . 82,247,580	15,846,164
Cream sold not as butterfat	value \$. . . 111,905,929	26,139,341
Butter churned	pounds . . . 707,666,492	542,064,289
" " "	value \$. . . 346,355,759	216,897,575
POULTRY PRODUCTS:		
Poultry raised	total value \$	647,725,650
Chickens raised	number . . . 473,200,699	673,092,052
" " "	value \$. . . 386,111,767	581,110,136
Chickens sold	number . . . 140,811,045	284,625,901
" " "	value \$. . . 119,722,603	262,516,035
Chicken eggs produced	dozens . . . 1,654,044,932	2,689,719,158
Chicken eggs produced	value \$. . . 661,082,803	799,261,156
Chicken eggs sold	dozens . . . 1,010,813,258	1,955,459,439
Chicken eggs sold	value \$. . . 404,562,912	585,868,022
OTHER PRODUCTS:		
Wool shorn	pounds . . . 228,795,354	295,964,506
" " "	value \$. . . 120,417,549	89,415,164
Mohair clipped	pounds . . . 6,808,890	14,460,572
" " "	value \$. . . 3,589,310	6,790,437
Honey	pounds . . . 55,224,061	83,546,415
" " "	value \$. . . 14,280,153	12,260,089

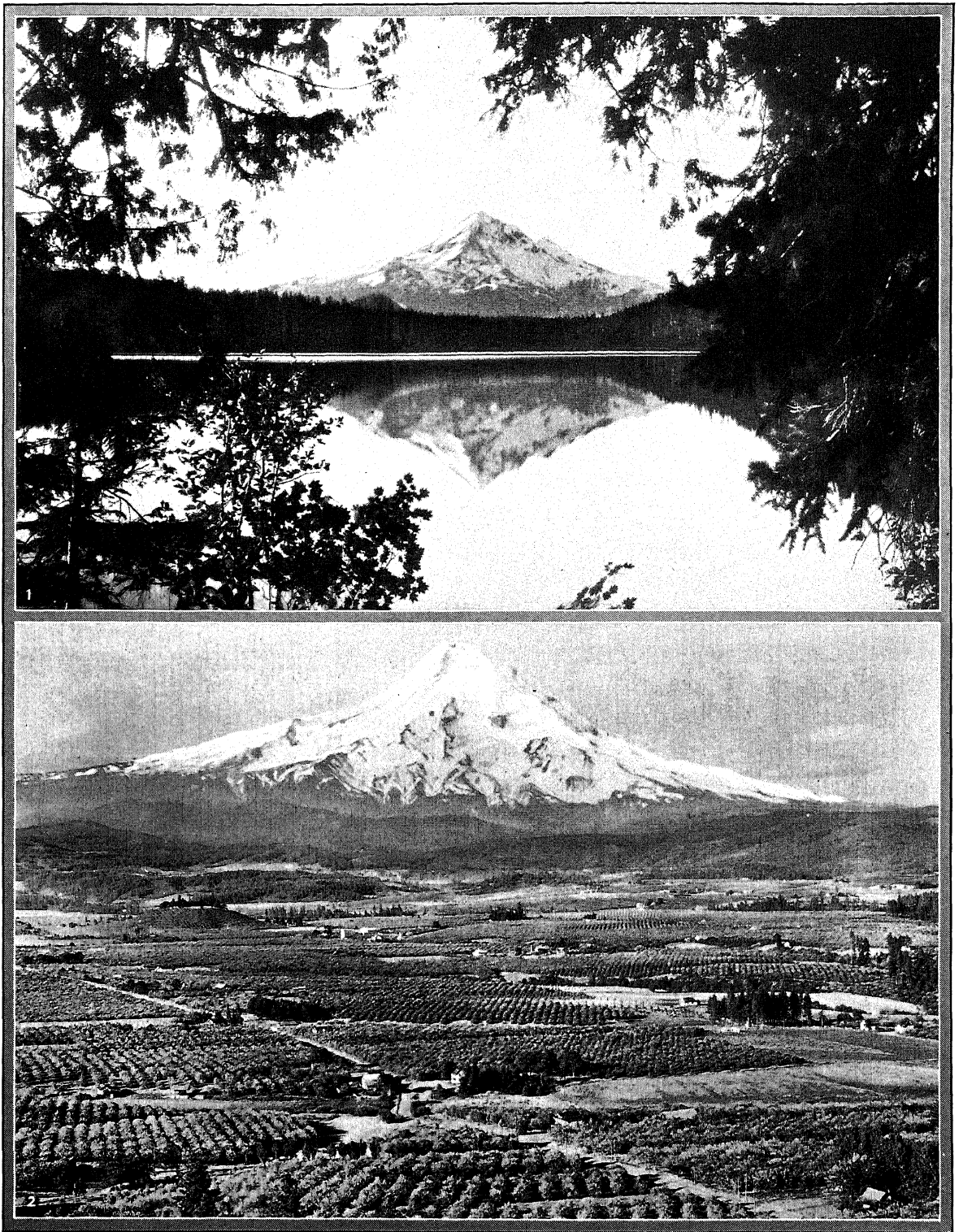
OTHER PRODUCTS:

Wool shorn	pounds . . . 228,795,354	295,964,506
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" " "	value \$. . . 3,589,310	6,790,437
Honey	pounds . . . 55,224,061	83,546,415
" " "	value \$. . . 14,280,153	12,260,089

For additional information see the section Animal Industry in the article on each of the several states; also articles on the principal domestic animals reared, as CATTLE RAISING; DAIRYING; HOG RAISING; HORSE RAISING; MEAT TRADE; MILK; POULTRY KEEPING; SHEEP RAISING, and related subjects.

Fisheries. The fishery industries of the United States are exceedingly varied and extensive. They em-

UNITED STATES OF AMERICA

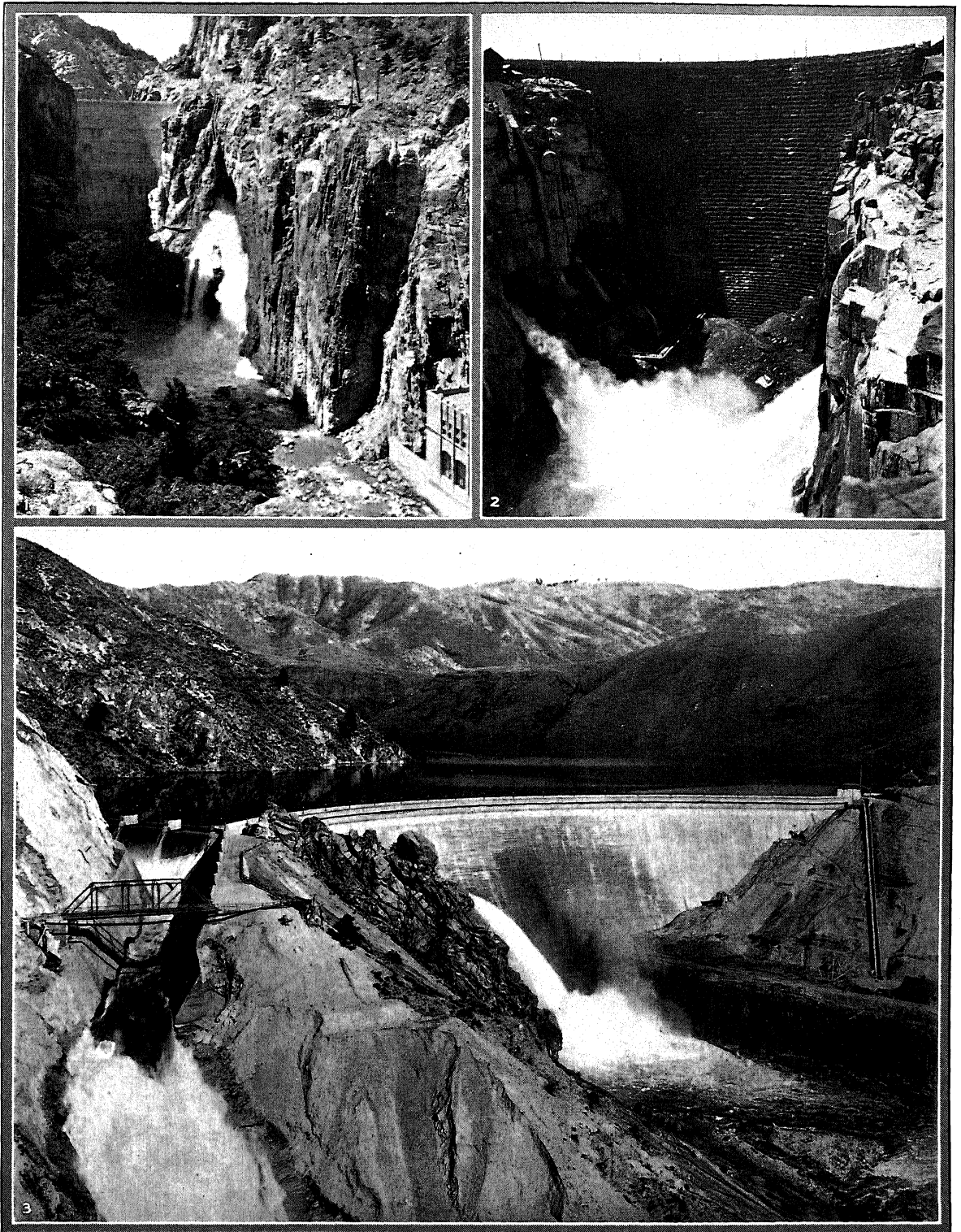


COURTESY OREGON STATE CHAMBER OF COMMERCE. COPYRIGHT ARTHUR M. PRENTIS

MOUNT HOOD, NORTHERN OREGON

1. A picturesque view of Mount Hood, altitude 11,253 feet, in the center of Mount Hood National Forest.
2. The Hood River Valley with Mount Hood in the background. Apples, pears, peaches and cherries are extensively cultivated.

UNITED STATES OF AMERICA

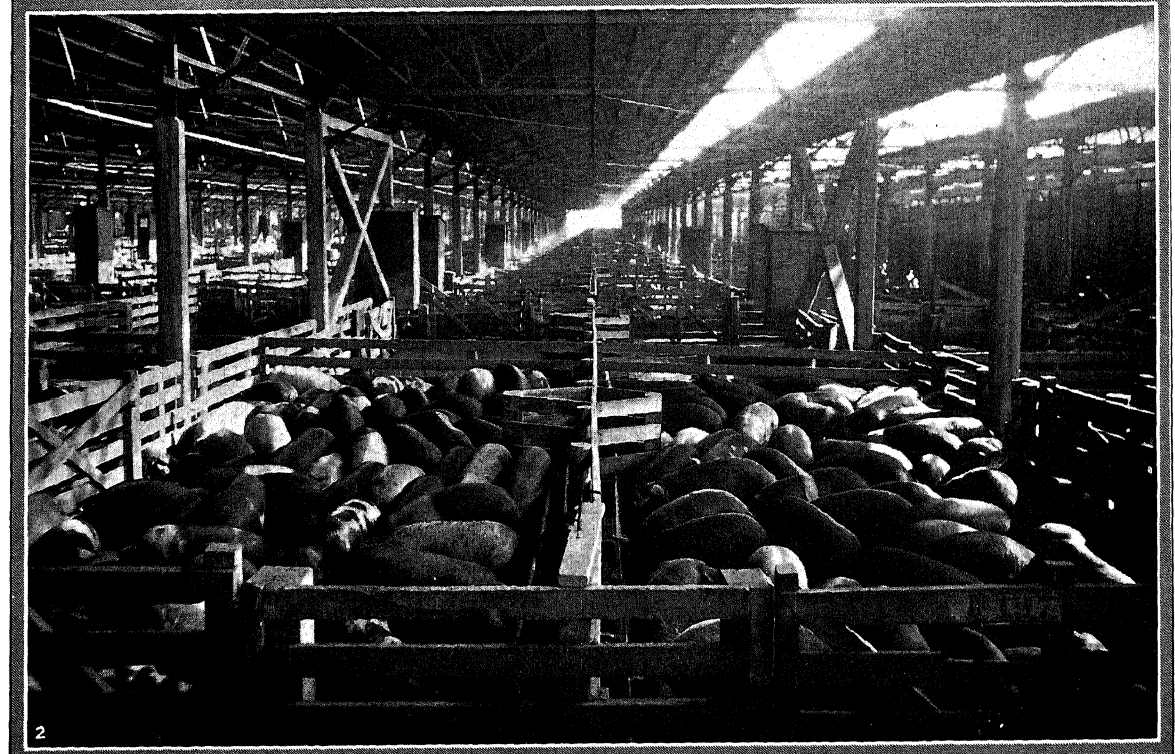
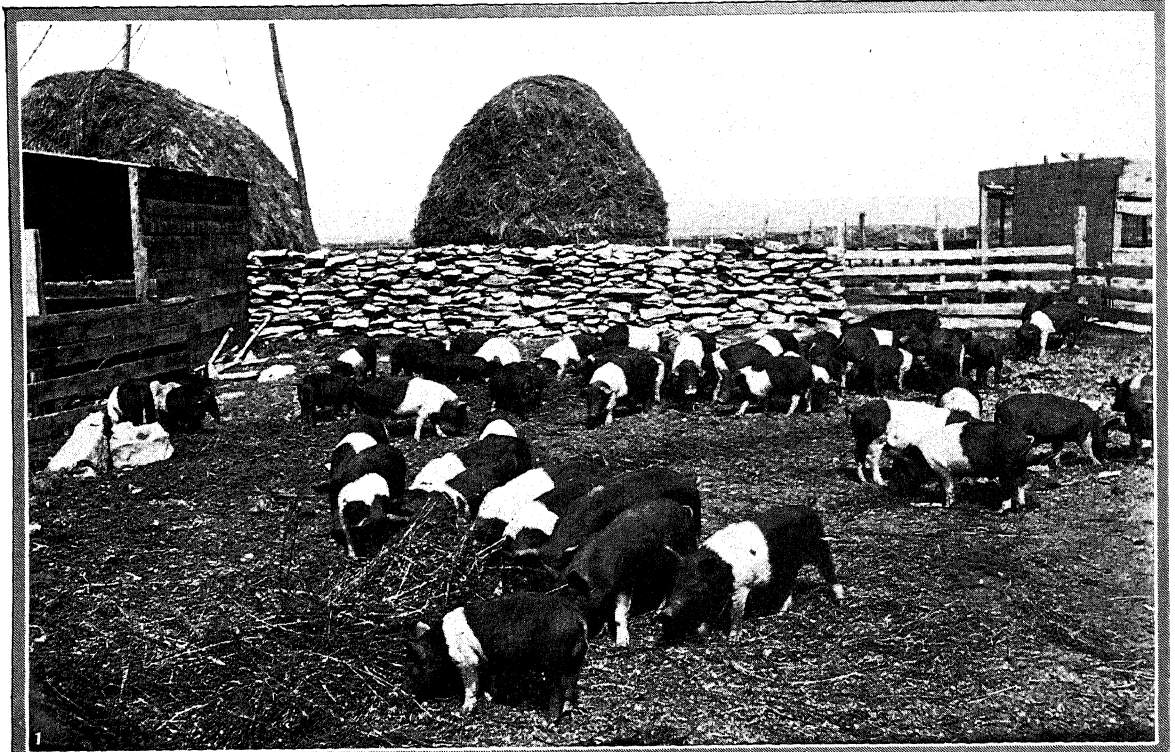


COURTESY U.S. BUREAU OF RECLAMATION

GOVERNMENT-OWNED IRRIGATION DAMS

1. Shoshone Dam, Shoshone River, near Cody, Wyoming; completed 1910; height, 328 ft. 2. Pathfinder Dam, North Platte River, near Casper, Wyoming; completed 1922; height, 218 ft. 3. Arrowrock Dam, Boise River Project, Idaho.

UNITED STATES OF AMERICA



1, COURTESY DEPT. COMMERCE AND INDUSTRY, CHEYENNE, WYO.; 2, OMAHA CHAMBER OF COMMERCE

SCIENTIFIC HOG RAISING IN THE UNITED STATES

1. Young hogs on a farm in Wyoming being fattened for shipment. 2. Hogs in the pens of the South Omaha, Nebraska, live-stock district, awaiting transportation. Over 3,000,000 head of hogs pass through these pens each year.

UNITED STATES

Ar. 3,026,789 sq. m.
Pop. 122,775,046
(Capital)

WASHINGTON, D. C.
Pop. 486,869

ALABAMA... M 18
Pop. 2,646,248

ARIZONA... L 15
Pop. 435,573

ARKANSAS... L 15
Pop. 1,854,482

CALIFORNIA... I 2
Pop. 5,677,251

COLORADO... I 9
Pop. 1,035,791

CONNECTICUT... F 24
Pop. 1,606,903

DELAWARE... H 23
Pop. 238,380

DISTRICT OF COLUMBIA...
Pop. 486,869

FLORIDA... P 21
Pop. 1,468,211

GEORGIA... M 20
Pop. 2,908,506

IDAHO... E 5
Pop. 445,032

ILLINOIS... H 16
Pop. 7,630,654

INDIANA... H 18
Pop. 3,238,503

IOWA... M 14
Pop. 2,470,939

KANSAS... J 12
Pop. 1,880,999

KENTUCKY... J 18
Pop. 2,614,589

LOUISIANA... O 15
Pop. 2,101,593

MAINE... C 25
Pop. 797,423

MARYLAND... H 23
Pop. 1,681,526

MASSACHUSETTS... F 24
Pop. 4,249,614

MICHIGAN... F 18
Pop. 4,842,325

MINNESOTA... E 14
Pop. 2,563,953

MISSISSIPPI... N 17
Pop. 2,009,821

MISSOURI... J 15
Pop. 3,629,367

MONTANA... F 8
Pop. 537,606

NEBRASKA... H 11
Pop. 1,377,963

NEVADA... H 4
Pop. 91,058

NEW HAMPSHIRE... D 24
Pop. 465,293

NEW JERSEY... G 23
Pop. 4,041,334

NEW MEXICO... L 8
Pop. 423,317

NEW YORK... F 22
Pop. 12,588,066

NORTH CAROLINA... K 21
Pop. 3,170,276

NORTH DAKOTA... C 11
Pop. 680,845

OHIO... H 20
Pop. 6,046,697

OKLAHOMA... L 12
Pop. 2,396,040

OREGON... D 3
Pop. 953,786

PENNSYLVANIA... G 22
Pop. 9,631,350

RHODE ISLAND... F 25
Pop. 687,497

SOUTH CAROLINA... L 21
Pop. 1,738,765

SOUTH DAKOTA... E 12
Pop. 692,849

TENNESSEE... K 18
Pop. 2,616,556

TEXAS... O 12
Pop. 5,824,715

UTAH... I 6
Pop. 507,847

VERMONT... E 23
Pop. 359,611

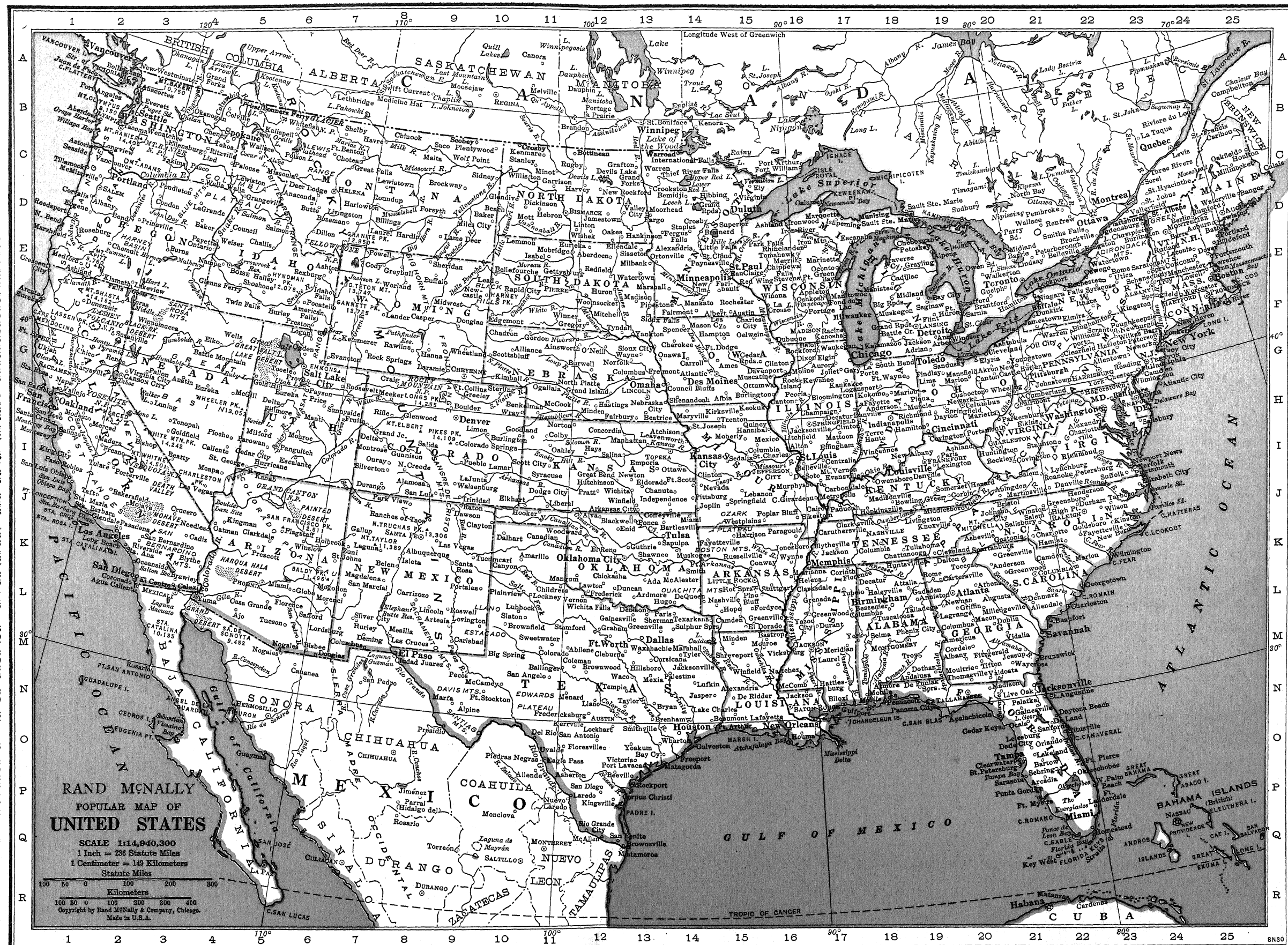
VIRGINIA... I 22
Pop. 2,421,851

WASHINGTON... B 3
Pop. 1,563,396

WEST VIRGINIA... I 21
Pop. 1,729,205

WISCONSIN... F 16
Pop. 2,939,006

WYOMING... F 8
Pop. 225,565



brace large marine fishing grounds in both Atlantic and Pacific waters, and also extensive fresh-water fisheries in the Great Lakes region and in numerous rivers, including the valuable salmon fisheries in the streams of the Pacific Coast. Important information concerning these industries is presented in the article FISHERIES and also in the numerous articles on the principal food fishes, as BLUEFISH; COD; HALIBUT; HADDOCK; HERRING; LAKE TROUT; MACKEREL; SALMON; SHAD; WHITEFISH.

Minerals and Mining. In both the production and the consumption of coal, petroleum, natural gas, iron, copper, lead, zinc and various other minerals of the highest economic value the United States stands first in the world. The remarkable progress of the country in agriculture, transportation and manufacturing, for which history affords no parallel, has resulted very largely from the utilization of vast natural resources, among the chief of which are minerals. These have been developed in mines, quarries and oil fields of immense extent and continent-wide distribution, yielding practically all the minerals of basic importance in the maintenance of the nation's manufacturing industries, now of greater magnitude than those of any other country.

During Colonial times there was little utilization of native minerals and prior to 1850 the mining industry of the United States was relatively insignificant. In Pennsylvania bituminous coal was regularly mined in 1750 and anthracite in 1800, though neither was largely produced until the extensive development of railroads which took place about 1850. The smelting of iron, sparingly practiced very early in Pennsylvania, New York and New Jersey, did not assume importance until after 1840. Since the discovery of petroleum in Pennsylvania in 1859 the United States has produced more than 60% of the world's total output. Following the discovery in 1848 of placer deposits in California, the United States for many years was the world's chief producer of gold, as it was also of silver beginning with the development in 1859 of the Comstock lode in Nevada. Substantial production of copper followed the opening of the Lake Superior mines in 1845 and world leadership in copper production was established in the 1870's. After the Civil War expansion in the production of coal, iron ore, petroleum and other highly important minerals was rapid and continuous.

VALUE OF MINERAL PRODUCTIONS, U.S., 1880-1930

Year	Metallic Value \$	Nonmetallic Value \$	Total Value \$
1880	187,881,000	173,582,000	367,463,000
1885	172,218,000	242,333,000	419,551,000
1890	303,440,000	310,995,000	615,429,000
1895	248,033,000	393,658,000	642,691,000
1900	513,732,000	594,204,000	1,108,936,000
1905	702,585,000	920,780,000	1,623,365,000
1910	749,879,000	1,237,668,000	1,987,844,000
1915	991,730,000	1,400,484,000	2,394,644,000
1920	1,762,350,000	5,214,170,000	6,981,340,000
1925	1,380,280,000	4,291,100,000	5,677,630,000
1930	982,550,000	3,818,950,000	4,810,400,000

The value of the mineral products of the United States for the period 1880-1930 at five-year intervals is given in the preceding table. The figures for total value include minerals not specified as metallic or nonmetallic amounting for the entire period to \$149,187,000.

The totals for the 51-year period 1880-1930 are metallic minerals \$37,381,490,000 and nonmetallic minerals \$81,472,012,000, which, together with the value of unspecified minerals, gives a grand total for all mineral products of \$119,002,689,000.

In point of value the 20 leading mineral products with the principal states producing each are set forth in the accompanying table:

CHIEF MINERAL PRODUCTS, U.S., 1929

Rank	Item	Value \$	Principal Producing States
1	Coal	1,338,423,751	Pa., W.Va., Ill., Ken.
2	Petroleum	1,280,417,000	Okla., Tex., Calif., Kans.
3	Pig iron	731,858,075	Pa., Ohio, Ill., Ind.
4	Natural gas	413,276,000	W.Va., Calif., Tex., Okla.
5	Clay products	373,409,391	Ohio, Pa., N.J., Ill.
6	Copper	352,504,000	Ariz., Utah, Mont., Mich.
7	Coke	278,994,592	Pa., Ind., Ohio, Ill.
8	Cement	255,104,506	Pa., Calif., Mich., Ind.
9	Stone	202,692,762	Ind., Pa., N.Y., Ohio
10	Iron ore	197,148,640	Minn., Mich., Ala., Wis.
11	Natural gasoline	158,410,000	Calif., Okla., Tex., W.Va.
12	Sand and gravel	129,047,508	N.Y., Pa., Ohio, Ill.
13	Lead	84,735,000	Mo., Utah, Idaho, Okla.
14	Zinc	80,802,000	Okla., N.J., Kans., Mont.
15	Ferro-alloys	75,506,078	Pa., N.Y., Va., Ohio
16	Aluminum	51,864,000	N.Y., Tenn., N.C.
17	Gold	45,651,400	Calif., S.D., Utah
18	Sulphur	43,800,000	Tex., Nev., Utah
19	Lime	33,478,848	Ohio, Pa., Mo., W. Va.
20	Silver	32,687,754	Utah, Mont., Idaho, Ariz.

The 16 states leading in mineral production with value of output in 1929 are given in the following table:

PRINCIPAL MINERAL-PRODUCING STATES, 1929

State	Value of Products \$	State	Value of Products \$
Pennsylvania	892,913,833	Michigan	151,975,563
California	554,916,020	Minnesota	136,349,610
Oklahoma	516,685,232	Kentucky	132,649,508
Texas	495,819,500	Kansas	124,472,480
West Virginia	346,564,746	Utah	115,130,581
Ohio	220,061,343	New York	109,361,349
Illinois	182,791,131	Indiana	96,961,947
Arizona	157,959,792	Montana	93,842,135

For additional details consult the articles on the various minerals and also the section on Minerals and Mining given in the article on each state of the Union.

Transportation. The establishment of inland waterways marked the first major step in the develop-

ment of the transportation facilities of the United States. The construction of a canal to connect Chesapeake Bay and Albemarle Sound was jointly authorized by the states of Virginia and North Carolina in 1787. The completion of this project in 1794 initiated an era of state canal building. Pennsylvania canalized the Schuylkill River from Philadelphia to Mt. Carbon in 1826, and the Lehigh River from Easton to Bristol shortly afterward. The state's combination water and rail route from Philadelphia to Pittsburgh was also started at about this time. Ohio's canal building started in 1825, and was intensively carried on for more than a decade. Illinois and other states also spent huge sums on canal improvements. However, the only canal system that has successfully withstood the competition of other types of transportation for more than a century is the New York State Barge Canal System.

After the completion of the Champlain Canal by New York State in 1823, the Erie Canal, completed in 1825, the Oswego Canal, completed in 1828, and several smaller tributary canals, established a waterway connecting New York City with the Great Lakes. The tonnage handled by this waterway increased steadily to a peak of about 6,000,000 tons in the years immediately following the Civil War. Railway competition then began to be felt, and the volume of traffic declined to about 1,800,000 tons in 1918. An extensive improvement of the system was then again undertaken by New York State. This resulted in a steady growth in traffic volume to approximately 3,600,000 tons in 1930.

During 1929 the Great Lakes inland waterway carried a total of 20,159,000 tons of foreign commerce and 135,838,000 tons of domestic interport traffic. Traffic moving through the canals at Sault Ste. Marie alone aggregated 72,898,000 tons in 1930.

The Mississippi river system is an important transportation artery between Minneapolis and New Orleans. It handled nearly 15,000,000 tons of traffic during 1929. Traffic on the Warrior river system in Alabama is growing steadily. In 1929 this system handled 1,938,773 tons as compared with 1,758,358 tons in 1928. It competes successfully with the railroads in transporting the steel and cotton of the rich district which it penetrates. The canalization of the Ohio River, completed in 1929, affords another internal waterway with economical transportation. The total tonnage transported on this system in 1929 was 60,968,728 tons.

The Baltimore and Ohio, America's pioneer steam railroad, was chartered in 1827. Its first section, 13 mi. long, from Baltimore to Ellicott's Mills, Md., was opened in May 1830. From the standpoint of performance the Charleston & Hamburg line of South Carolina, also chartered in 1827, is probably entitled to precedence over the B. & O. However, by Jan. 1, 1830, the "Best Friend," the first practical American-built locomotive, had made its maiden trip over six mi. of this line. By 1834, 137 mi. of track was operated by the Charleston & Hamburg, and for a short time it was the longest railroad in the world

under one management. In New York State, the Mohawk & Hudson railroad was opened for service from Albany to Schenectady in 1831. Pennsylvania's first railroad, a link in the Philadelphia-Pittsburgh route, was completed in 1834. In Massachusetts, steam railroads were completed from Boston to Lowell and from Worcester to Providence, R.I. by 1835. In 1853 the Erie railroad opened the first trunk line in the Union, while the first transcontinental line was completed, to Oakland, Cal., by the finishing of the Union Pacific and Central Pacific railroads in 1869. On Jan. 1, 1930, there were 249,433 mi. of steam railroads in the United States. The following table shows the mileage operated by the country's leading railroads on Jan. 1, 1931:

Road	Mileage Operated	% of Total Mileage
New York Central Railroad.....	26,390	10.6
Southern Pacific System	16,914	6.8
Atchison, Topeka & Santa Fe R.R. .	13,312	5.3
Chicago, Milwaukee, St. Paul & Pacific R.R.	11,326	4.5
Pennsylvania Railroad	10,892	4.4
Union Pacific Railroad	9,841	3.9
Chicago, Burlington & Quincy R.R.	9,325	3.7
Great Northern Railway	8,371	3.4
Chicago, Rock Island & Pacific Ry.	8,218	3.3
Northern Pacific Railway	6,790	2.7
Southern Railway	6,730	2.7
Baltimore & Ohio Railroad.....	5,653	2.3
Atlantic Coast Line R.R.	5,162	2.1
Illinois Central R.R.	5,019	2.0

On Jan. 1, 1931, the grand total of all highway mileage in the United States was 3,009,066. The total mileage of all state highway systems (including Federally aided) was 324,496. This was divided into 98,275 mi. of non-surfaced roads and 226,221 mi. of surfaced roads. The surfaced roads included 58,208 mi. of Portland cement concrete roads, 8,071 mi. of bituminous concrete roads, 14,590 mi. of bituminous macadam roads and 106,728 mi. of improved gravel roads. The total mileage of all local roads was 2,684,570. This was divided into 2,217,232 mi. of non-surfaced roads and 467,338 mi. of surfaced roads. The surfaced roads included 14,656 mi. of Portland cement concrete roads, 6,019 mi. of bituminous concrete roads, 19,059 mi. of bituminous macadam roads and 310,308 mi. of improved gravel roads.

The total national highway expenditure during 1930 aggregated \$1,680,493,095. Of this amount, \$979,997,847 was spent for state highway systems and Federal aid, while \$700,495,248 was spent for local roads. The total income from all sources for state highways during 1930 was \$1,136,673,437; the total income available for local roads was \$818,379,508.

The increase in the number of motor vehicles using the highways of the United States is indicated by the rise in motor vehicle registrations. While total motor vehicle registrations aggregated but 8,000 in 1900, this figure rose to 468,500 in 1910, 9,231,941 in 1920 and to 26,523,779 in 1930. Trucking facilities, non-existent in 1900, have also increased with great rapidity. In contrast with the small registration of 10,000 trucks in

1910, 1,006,082 were registered in 1920 and 3,480,939 in 1930. Bus service has likewise spread rapidly, particularly in suburban communities near large centers of population. From 1925 to 1930, the number of buses in operation rose from 53,202 to 87,625. *See also* TRANSPORTATION; TRANSIT INDUSTRY.

Manufactures. Throughout Colonial times manufactures were but slightly developed and during the first 35 years of national life manufacturing was carried on mainly in small local shops or in the home. But in the next 35-year period, 1825-60, substantial progress was made. This was aided by several important factors, most of which are still basic in the nation's industrial life. Among the most influential of these were numerous labor-saving inventions, the utilization of steam and water power, the rapid growth of population, the great expansion of agriculture in the South and on the ever-widening western frontier, the development of mineral and forest resources, the use of anthracite in smelting iron, and an unparalleled improvement in transportation brought about by the construction of railroads. The rise, since the Civil War period, of the United States from a predominantly agricultural status to foremost rank among the manufacturing countries of the world is shown in the following table. The statistics for 1859-1899 inclusive, include factory, hand and neighborhood industries; the statistics for 1904-1929 include factory industries only.

MANUFACTURING INDUSTRIES, U.S., 1859-1929

Year	No. Establishments	Wage Earners	Wages \$	Value of Products \$
1859 ...	140,433	1,311,246	378,878,966	1,885,861,676
1869 ...	252,148	2,053,996	620,467,474	3,385,860,354
1879 ...	253,852	2,732,595	947,953,795	5,369,579,191
1889 ...	355,405	4,251,535	1,891,219,696	9,372,378,843
1899 ...	512,191	5,306,143	2,320,938,168	13,000,149,159
1904 ...	216,180	5,468,383	2,610,444,953	14,793,902,563
1909 ...	268,491	6,615,046	3,427,037,884	20,672,051,870
1914 ...	272,518	7,023,685	4,067,718,740	24,216,514,573
1919 ...	214,383	9,000,059	10,461,786,869	62,041,795,316
1925 ...	187,390	8,384,261	10,729,968,927	62,713,713,730
1927 ...	191,866	8,349,755	10,848,802,532	62,718,347,289
1929 ...	210,959	8,838,743	11,620,973,254	70,434,863,443

According to the Census of 1930 there were engaged in the 210,959 establishments devoted to manufacturing a total of 10,330,728 persons, of whom 133,210 were proprietors and firm members, 1,358,775 were salaried officers and employees, who received \$3,595,064,061 in salaries, and 8,838,743 were wage earners, who received \$11,620,973,254 in wages. These establishments used a total of 42,931,061 horse power, expended \$1,866,165,719 for fuel and power and \$36,683,414,013 for materials and supplies, turned out products valued at \$70,434,863,443, and added by the process of manufacture \$31,885,283,711 to the value of their output.

Statistics concerning important groups of manufactures, which in value comprised about 63% of the total for all factory industries, are given in the accompanying table.

LEADING MANUFACTURING INDUSTRIES, 1929

Industry or Product	No. persons engaged	Value of Products \$
Bread, bakery products ...	244,070	1,526,110,811
Canning and preserving: fruits and vegetables ...	110,551	750,342,041
Carshop construction ...	398,655	1,184,435,262
Chemicals ...	75,558	738,048,386
Cigars and cigarettes ...	115,957	1,066,908,888
Clothing, men's ...	169,143	901,104,205
Clothing, women's ...	222,404	1,709,580,505
Cotton goods ...	439,101	1,524,177,087
Electrical machinery ...	405,053	2,300,915,572
Flour, grain-mill products ...	39,126	1,060,269,418
Foundry and machine-shop ...	545,377	2,791,461,964
Furniture ...	219,799	948,116,358
Gas, manufactured ...	65,624	512,652,595
Iron and steel: Pig iron ...	27,376	771,425,464
Iron and steel: Steel works and rolling mills ...	431,528	3,365,788,805
Knit goods ...	223,340	899,716,672
Leather: finished ...	54,316	481,340,299
Lumber products ...	454,143	1,273,472,320
Meat packing ...	146,717	3,434,654,098
Motor vehicle bodies and parts ...	241,813	1,537,929,793
Motor vehicles ...	253,228	3,722,793,274
Paints and varnishes ...	42,333	568,975,838
Paper ...	115,096	967,186,026
Petroleum refining ...	94,405	2,639,665,001
Planing-mill products ...	109,864	553,583,498
Printing and publishing, book and job ...	204,901	1,006,656,768
Printing and publishing, newspaper and periodical ...	277,672	1,738,298,892
Rubber tires and inner tubes ...	96,249	770,176,890
Silk and rayon ...	139,039	731,200,231
Smelting, refining, copper ...	16,537	994,783,862
Structural iron and steel ...	69,337	477,036,827
Sugar refining, cane ...	15,659	507,389,262
Worsted goods ...	93,763	536,067,399

More than two-fifths (42.3%) of the nation's manufactures are produced in New York, Pennsylvania, Illinois, and Ohio. Another two-fifths (40.2%) is contributed by the twelve states ranking next in value of output, or 82.5% for the 16 leading states, as shown in the following table.

STATES LEADING IN MANUFACTURES, 1929

State	Rank	Value of Products \$	% of U.S. Total
New York ...	1	9,978,556,143	14.2
Pennsylvania ...	2	7,443,861,057	10.6
Illinois ...	3	6,282,092,240	8.9
Ohio ...	4	6,027,903,137	8.6
Michigan ...	5	4,656,718,046	6.6
New Jersey ...	6	3,937,156,775	5.6
Massachusetts ...	7	3,392,162,237	4.8
California ...	8	3,103,349,668	4.4
Indiana ...	9	2,539,893,849	3.6
Wisconsin ...	10	2,156,681,769	3.1
Missouri ...	11	1,917,155,275	2.7
Connecticut ...	12	1,471,875,604	2.1
Texas ...	13	1,450,246,431	2.1
North Carolina ...	14	1,311,924,352	1.9
Minnesota ...	15	1,173,213,606	1.7
Maryland ...	16	1,119,082,289	1.6

Further details regarding the factory industries are presented in the section Manufactures in the separate article on each state and also in numerous articles on

important industries, as AIRCRAFT INDUSTRY; BAKERY INDUSTRY; CANNING AND PRESERVING INDUSTRIES; CLOTHING INDUSTRY; COKE INDUSTRY; COTTON GOODS INDUSTRY; ELECTRIC MANUFACTURING INDUSTRY; FURNITURE INDUSTRY; LAUNDRIES, COMMERCIAL; MEAT-PACKING INDUSTRY; MOTOR-VEHICLE INDUSTRY; PAPER INDUSTRY; PRINTING AND PUBLISHING INDUSTRIES; RUBBER INDUSTRY; SOAP INDUSTRY; TOBACCO MANUFACTURE; WEARING APPAREL INDUSTRIES.

See also INDUSTRIAL GROWTH OF AMERICA.

Commerce. In 1929 there were 169,757 wholesale establishments in the United States, with total sales of \$69,490,771,331. These organizations gave full-time employment to 1,607,704 people, 294,770 women and 1,312,934 men. The annual salaries and wages of these employees aggregated \$3,015,109,766. The geographical concentration of this tremendous volume of wholesale trade is indicated by the fact that \$45,794,670,223, or over 65%, is accounted for by but eight states, as follows:

State	Wholesale Trade	% of Total
New York	\$16,664,514,767	25.41
Illinois	6,860,830,303	9.87
Pennsylvania	4,761,812,064	6.85
California	4,159,323,157	5.99
Missouri	3,361,561,643	4.84
Ohio	3,094,444,580	4.45
Massachusetts	3,087,684,593	4.44
Texas	2,804,509,116	4.04
Total	\$45,794,670,223	65.89

The geographical concentration of wholesale trade is further shown by the fact that a volume of \$35,682,096,609, more than half the total for the entire country, is handled by wholesaling organizations established in the following 11 cities:

City	Wholesale Trade	% of Total
New York, N.Y.	\$14,598,220,186	21.0
Chicago, Ill.	5,928,994,384	8.5
Boston, Mass.	2,409,048,248	3.5
Philadelphia, Pa.	2,265,489,053	3.3
San Francisco, Cal.	1,784,174,952	2.6
Detroit, Mich.	1,578,055,671	2.3
Pittsburgh, Pa.	1,562,495,436	2.2
Los Angeles, Cal.	1,540,821,704	2.2
St. Louis, Mo.	1,430,981,458	2.1
Kansas City, Mo.	1,408,793,238	2.0
Cleveland, Ohio	1,175,022,279	1.7
Total	\$35,682,096,609	51.4

An additional \$8,484,615,875, about 12% of the total wholesaling volume, is accounted for by 13 other cities which reported sales of \$500,000,000 to \$1,000,000,000 each. It is therefore evident that most of the wholesale distribution is carried on at the great centers of population, where the necessary warehousing and other wholesaling facilities can be economically maintained.

The total sales of the 1,548,168 retail stores in the United States in 1929 amounted to \$50,033,850,792. They may be classified as follows:

Groups	No. of Stores	Sales	% of Total
Foods	497,715	\$11,310,627,359	22.61
Automotive	253,322	9,546,897,913	19.08
General Merchandise	70,263	7,140,515,384	14.27
Apparel	112,960	4,315,234,497	8.62
Lumber and Building	79,839	3,637,053,607	7.27
Furniture and Household	44,417	2,286,007,992	4.57
Restaurants	135,674	2,097,170,528	4.19
General Stores	87,683	1,927,622,967	3.85
All other stores	267,295	7,772,720,545	15.54
Total	1,549,168	\$50,033,850,792	100.00

Average sales per store were \$32,297, though there is great deviation from this average in many states. The lowest average sales per store were reported in South Carolina, with \$19,827 per store. The highest sales per store, \$39,715, were reported in Michigan, which also showed high per capita sales. Average per capita sales for the entire country were \$407.52, while Michigan reported \$461.67. California reported the highest sales per capita, \$575.73; New York, with \$575.12, also made an excellent showing.

There was a decided tendency toward higher sales per store and sales per capita in large cities, as opposed to small cities and rural districts. This is probably a reflection of the greater attraction of the larger cities as retail trading centers, rather than an indication of the higher purchasing power of the residents of those cities.

There were 7,083 retail chain organizations in the country in 1929, operating 156,029 stores. Of these, 337 operated more than 50 units; 395, from 26 to 50 units; 1,176, from 11 to 25 units; and 1,998, from 6 to 10 units. Chain stores constituted a noticeably higher percentage of the total number of retail outlets in larger cities than in small cities and rural districts.

The total water-borne commerce of the United States during 1930 aggregated 520,280,000 tons, with a value of \$20,122,000,000. Of this total, 323,484,920 tons, valued at \$17,727,836,501, were handled by Atlantic, Gulf and Pacific ports, while 135,241,077 tons, valued at \$1,676,992,545, were handled by the Great Lakes ports. After eliminating all known duplications, the traffic on the Mississippi River and its tributaries, including the Ohio River system, amounted to 78,811,931 tons, valued at \$1,080,208,116.

In 1930, the water-borne commerce of the principal ports with foreign countries was as follows:

Port	Imports (Tons)	Exports (Tons)	Imports (000 Dol-lars)	Exports (000 Dol-lars)
Baltimore, Md.	5,502,169	969,485	111,195	177,732
Boston, Mass.	2,385,564	275,327	187,319	223,641
Galveston, Tex.	348,580	1,841,117	8,898	144,270
Houston, Tex.	386,793	5,259,929	10,634	274,928
Los Angeles, Cal.	716,381	5,854,936	47,523	188,768
New Orleans, La.	2,929,598	3,088,445	135,895	243,328
New York, N.Y.	17,642,246	9,048,382	2,000,756	1,927,591
Norfolk, Va.	800,525	1,362,332	56,866	107,644
Philadelphia, Pa.	3,298,067	4,770,718	154,985	239,287
Portland, Ore.	134,331	1,682,171	14,144	43,749
San Francisco, Cal.	1,234,134	1,673,648	336,341	171,531
Savannah, Ga.	603,052	310,470	17,788	40,408
Seattle, Wash.	406,677	504,961	149,478	41,683

The principal exports included machinery, cotton, petroleum and petroleum products, automobiles and parts, wheat, packing-house products, tobacco, and products of iron and steel mills. The chief imports were raw silk, coffee, paper, newsprint and manufactures, oil, crude rubber, cane sugar and copper. *See also* COMMERCE; EXPORTS AND IMPORTS; FOREIGN TRADE.

National Finance. The chief features of the nation's financial system, including income, expenditures, banking, coinage, money, domestic indebtedness and war debts are discussed in detail in numerous separate articles.

For information concerning national income and expenditures *see* CUSTOMS DUTIES; INCOME TAX; INTERNAL REVENUE; TARIFF COMMISSION; NATIONAL BUDGET.

Regarding the national monetary system *see* the articles BIMETALLISM; COINAGE; CURRENCY, MODERN; DOLLAR; GOLD; GREENBACKS; MINT; MONEY; MONOMETALLISM.

The national banking system is discussed in the articles BANKS AND BANKING; BANK OF THE UNITED STATES; FEDERAL RESERVE SYSTEM; FINANCE; NATIONAL BANK ACT; POSTAL SAVINGS SYSTEM; SAVINGS BANKS, UNITED STATES.

The national indebtedness and foreign war debts are treated under the articles BANK FOR INTERNATIONAL SETTLEMENTS; DAWES PLAN; LIBERTY LOAN; NATIONAL DEBT; WAR DEBTS; WAR FINANCE; YOUNG PLAN.

Government. In accordance with the provisions of the Constitution the national government consists of three departments or branches, the legislative, the executive, and the judicial.

The legislative branch consists of the Congress, which comprises two coordinate bodies, the Senate, composed of 96 senators, two from each state, and the House of Representatives, composed, according to the last apportionment, of 435 representatives. The senators are elected for a term of six years and the representatives for a term of two years.

The executive branch consists of the President, the Vice-President, and the Cabinet which is composed of the heads of the ten executive departments. The President and the Vice-President are elected for a term of four years; the heads of the executive departments, namely, state, treasury, war, justice, post-office, navy, interior, agriculture, commerce, and labor, are appointed by the President with the advice and consent of the Senate.

The judicial department consists of the Supreme Court of the United States, composed of a chief justice and eight associate justices, and also of a group of inferior Federal courts including the U.S. Circuit Courts of Appeals, the U.S. District Courts, the U.S. Court of Claims, and the U.S. Court of Customs Appeals.

Details regarding the functions of the several departments are discussed in articles on the subjects mentioned, especially CONSTITUTION OF THE UNITED STATES; CONGRESS OF THE UNITED STATES; REPRESENTA-

TIVES, HOUSE OF; SENATE; PRESIDENT OF THE UNITED STATES; ELECTORAL COLLEGE; CABINET; STATE, DEPARTMENT OF; WAR, DEPARTMENT OF; TREASURY DEPARTMENT, UNITED STATES; SUPREME COURT OF THE UNITED STATES, and articles on various subjects referred to in connection with the foregoing.

Education. Public education has been one of the basic principles of national development in the United States. In a majority of states education from the kindergarten through the university is available entirely without charge or at a minimum fee when the university is reached. Details of educational systems and facilities are given in the section, Education, under the various states. *See also* the articles on state universities as MICHIGAN, UNIVERSITY OF; ILLINOIS, UNIVERSITY OF; CALIFORNIA, UNIVERSITY OF. In some instances institutions of higher learning are supported by cities as described under URBAN OR MUNICIPAL COLLEGES AND UNIVERSITIES. Other concrete phases of universal education and of educational privileges in the United States will be found under EVENING SCHOOLS; CONTINUATION SCHOOLS; CORPORATION SCHOOLS; CORRESPONDENCE SCHOOLS; UNIVERSITY EXTENSION; DEFECTIVE CLASSES, EDUCATION OF; MENTAL DEFECTIVES, EDUCATION OF; LIBRARIES, EDUCATION, NATIONAL SYSTEMS OF: United States. Privately endowed colleges and universities (*see* YALE, HARVARD, PRINCETON, VASSAR, SMITH, BRYN MAWR and other articles under the heads of the various colleges and universities) have long been a feature of our educational system.

The Government of the United States supports no general educational institutions but does maintain certain specialized schools as the WEST POINT MILITARY ACADEMY, the ANNAPOLIS NAVAL ACADEMY, HOWARD UNIVERSITY for colored pupils in Washington, D.C., and the Government Indian Schools in the Southwest and in Alaska. (*See* EDUCATION, UNITED STATES BUREAU OF.)

For further detailed information the following articles may be also consulted: UNITED STATES EDUCATION STATISTICS; UNIVERSITIES AND COLLEGES; ADULT EDUCATION; AGRICULTURAL EDUCATION; INDUSTRIAL EDUCATION; VOCATIONAL SCHOOLS; NATIONAL EDUCATIONAL ASSOCIATION, THE; RELIGIOUS EDUCATION; PAROCHIAL SCHOOLS; WOMEN, EDUCATION OF; COEDUCATION; PUBLIC SCHOOLS; PRIVATE SCHOOLS; EXPERIMENTAL EDUCATION; NEGRO EDUCATION; PROFESSIONAL SCHOOLS; ELEMENTARY EDUCATION; SECONDARY EDUCATION; JUNIOR HIGH SCHOOLS; JUNIOR COLLEGES; KINDERGARTEN; BLIND, WELFARE AND EDUCATION OF; DEAF, EDUCATION OF.

Religious Bodies. The statistics of religious bodies in the United States, taken decennially by the Bureau of the Census, show for 1926 upwards of 200 religious denominations represented by about 232,000 organizations embracing a total of 54,625,000 members. The church property owned by these organizations included nearly 211,000 church edifices, valued at about \$3,840,000,000. The expenditures of these religious organizations for the year 1926 exceeded \$817,000,000.

Details regarding various religious bodies are presented in numerous separate articles, as ADVENTIST CHURCHES; BAPTISTS; CONGREGATIONALISTS; DISCIPLES OF CHRIST; EASTERN ORTHODOX CHURCH; FRIENDS, SOCIETY OF; JUDAISM; LUTHERANS; METHODISM; MORMONISM; PRESBYTERIAN CHURCH; PROTESTANT EPISCOPAL CHURCH; REFORMED CHURCH IN AMERICA; REFORMED CHURCH IN THE UNITED STATES; ROMAN CATHOLIC CHURCH; UNITARIANISM; UNIVERSALIST CHURCH.

Social Welfare Institutions. Four eleemosynary institutions are operated in Washington, D.C., by the Federal Government under the supervision of the Department of the Interior. The Freedmen's Hospital for the colored race provides medical and surgical care for charity cases in the 48 states, as well as in the District of Columbia, and also has paying patients. It was established Mar. 3, 1871, under the War Department, but was transferred to the Interior Department, June 23, 1874. St. Elizabeth's Hospital, for the treatment of mental diseases in the Army, Navy and District of Columbia, was established Mar. 3, 1855. It also has a graduate school for psychiatrists. Howard University, an institution for the higher education of the colored race, was established Mar. 2, 1867. It offers liberal arts and sciences, medicine, law and religion. The annual enrollment exceeds 2,000. Columbia Institution for the Deaf cares for deaf mutes from the 48 states, the territories and the District of Columbia. It was established Feb. 16, 1857.

Veterans of the World War are cared for in 54 Veterans' Hospitals (June 30, 1931), having a combined capacity of 26,307 beds. Of these hospitals, 20 are general, 20 chiefly used for neuropsychiatric cases and 14 for tuberculosis cases. A grand total of 36,039 beds maintained for veterans includes, in addition, 2,265 by the Army, 3,794 by the Navy, 2,252 in National Homes, 1,039 by the United States Public Health Service and 382 by the Department of the Interior. Outpatient supervision and treatment is maintained through 54 regional offices located in the various states with the exception of Delaware, also through special facilities at certain of the Veterans' Hospitals, by medical treatment stations located in the smaller centers of population and by designated examiners in remote communities. Physical examinations made by the regional offices for the fiscal year ending June 30, 1931, totaled 1,933,698; the number of treatments totaled 829,040.

Population. The growth of the United States in population since the establishment of the Federal Government in 1789 has greatly exceeded that of any other nation. During the period 1790 to 1930, the population multiplied almost 32 times, approximately 3,190%. The population at each decennial census, with number and per cent of increase and density of population per square mile, is shown in the following table.

Of the 1930 population there were 108,864,207 or 88.7% whites, 11,891,143 or 9.7% negroes, 1,422,533 or 1.2% Mexicans, 332,397 or 0.3% Indians, 138,834 or 0.1% Japanese, 74,954 Chinese, 45,208 Filipinos, 3,130 Hindus and 1,224 Koreans. The whites showed

POPULATION, CONTINENTAL UNITED STATES,
1790-1930

Census Year	Population	Increase Over Preceding Census		Pop. per Sq. Mile
		Number	Per Cent	
1790	3,929,214			4.5
1800	5,308,483	1,379,269	35.1	6.1
1810	7,239,881	1,931,398	36.4	4.3
1820	9,638,453	2,398,572	33.1	5.5
1830	12,866,020	3,227,567	33.5	7.3
1840	17,069,453	4,203,433	32.7	9.7
1850	23,191,876	6,122,423	35.9	7.9
1860	31,443,321	8,251,445	35.6	10.6
1870	38,558,371	7,115,050	22.6	13.0
1880	50,155,783	11,597,412	30.1	16.9
1890	62,947,714	12,791,931	25.5	21.2
1900	75,994,575	13,046,861	20.7	25.6
1910	91,972,266	15,977,691	21.0	30.9
1920	105,710,620	13,738,354	14.9	35.5
1930	122,775,046	17,064,426	16.1	41.3

an increase over 1920 of 14.8%; the negroes, 13.6%; the Mexicans, 103.1%; the Indians, 36%; the Japanese, 25.1%; the Chinese, 21.6%; the Filipinos, 706.9%; the Hindus, 24.9%, and the Koreans, 50%. Of the whites, 95,497,800 were native born, an increase of 14,632,820 or 18.1% from 1920, and 13,366,407 were foreign born, an increase of 111,013 or 0.8% from 1920. The total foreign stock (38,727,593), comprising foreign born, foreign and mixed parentage, included the following:

CHIEF GROUPS FOREIGN WHITE STOCK, 1930

Nationality	Number	Per Cent
Germans	6,873,103	17.7
Italians	4,546,875	11.7
Poles	3,342,198	8.6
Irish	3,086,522	8.0
Russians	2,669,838	6.9
English	2,522,261	6.5
Canadians (other than French)	2,231,186	5.8
Swedes	1,562,703	4.0
Czechoslovakians	1,382,079	3.6
French Canadians	1,106,159	2.9
Norwegians	1,100,098	2.8
Austrians	954,648	2.5
Scotch	899,591	2.3
Northern Irish	695,999	1.8
Hungarians	590,768	1.5
Danes	529,142	1.4

The urban population was 68,954,823 or 56.2% of the total, an increase of 14,650,220 or 27.0% from 1920; the rural population was 53,820,223 or 43.8% of the total, an increase of 2,414,206 or 4.7% since 1920.

Noteworthy aspects of the population movements during the decade 1920-1930 were the marked decline in European immigration and in the per cent of foreign born; the increase of Mexican immigration in the Southwest; the decline in the per cent of increase of the negro population to below that of the white population; the shift of southern negroes to northern urban centers; the rapid growth of the larger cities, and the decline in rural population.

GROWTH OF 50 LEADING CITIES, 1910-1930

City and Rank	Pop. 1930	Pop. 1920	Pop. 1910
1. New York, N.Y.	6,930,446	5,620,048	4,766,883
2. Chicago, Ill.	3,376,438	2,701,705	2,185,283
3. Philadelphia, Pa.	1,950,961	1,823,779	1,549,008
4. Detroit, Mich.	1,568,662	993,678	465,766
5. Los Angeles, Calif.	1,238,048	576,673	319,198
6. Cleveland, Ohio	900,429	796,841	560,663
7. St. Louis, Mo.	821,960	772,897	687,029
8. Baltimore, Md.	804,874	733,826	558,485
9. Boston, Mass.	781,188	748,060	670,585
10. Pittsburgh, Pa.	669,817	588,343	533,905
11. San Francisco, Calif.	634,394	506,676	416,912
12. Milwaukee, Wis.	578,249	457,147	373,857
13. Buffalo, N.Y.	573,076	506,775	423,715
14. Washington, D.C.	486,869	437,571	331,069
15. Minneapolis, Minn.	464,356	380,582	301,408
16. New Orleans, La.	458,762	387,219	339,075
17. Cincinnati, Ohio	451,160	401,247	363,591
18. Newark, N.J.	442,337	414,524	347,469
19. Kansas City, Mo.	399,746	324,410	248,381
20. Seattle, Wash.	365,883	315,312	237,194
21. Indianapolis, Ind.	364,161	314,194	233,650
22. Rochester, N.Y.	328,132	295,750	218,149
23. Jersey City, N.J.	316,715	298,103	267,779
24. Louisville, Ky.	307,745	234,891	223,928
25. Portland, Oreg.	301,815	258,288	207,214
26. Houston, Tex.	292,352	138,276	78,800
27. Toledo, Ohio	290,718	243,164	168,497
28. Columbus, Ohio	290,564	237,031	181,511
29. Denver, Colo.	287,861	256,491	213,381
30. Oakland, Calif.	284,063	216,261	150,174
31. St. Paul, Minn.	271,606	234,698	214,744
32. Atlanta, Ga.	270,366	200,616	154,839
33. Dallas, Tex.	260,475	158,976	92,104
34. Birmingham, Ala.	259,678	178,806	132,685
35. Akron, Ohio	255,040	208,435	69,067
36. Memphis, Tenn.	253,143	162,351	131,105
37. Providence, R.I.	252,981	237,595	224,326
38. San Antonio, Tex.	231,542	161,379	96,614
39. Omaha, Neb.	214,006	191,601	124,096
40. Syracuse, N.Y.	209,326	171,717	137,249
41. Dayton, O.	200,982	152,559	116,577
42. Worcester, Mass.	195,311	179,754	145,986
43. Oklahoma City, Okla.	185,389	91,295	64,205
44. Richmond, Va.	182,929	171,667	127,628
45. Youngstown, O.	170,002	132,358	79,066
46. Grand Rapids, Mich.	168,592	137,634	112,571
47. Hartford, Conn.	164,072	138,036	98,915
48. Fort Worth, Tex.	163,447	106,482	73,312
49. New Haven, Conn.	162,655	162,537	113,605
50. Flint, Mich.	156,492	91,599	38,550

In 1790 the geographical center of population was approximately 23 mi. east of Baltimore, Md., in $39^{\circ} 16' 30''$ N. lat. and $76^{\circ} 11' 12''$ W. long. During each decade since the center of population has moved westward with only slight deviations north or south of the 39th parallel of latitude. In the 140-year period 1790-1930 the average movement westward was about 41.5 mi. for each decade and the net average movement southward was about a mile for each decade. According to the Census of 1930 the center of population was at a point 2.9 mi. northeast of Linton, Greene Co., Ind., in $39^{\circ} 3' 45''$ N. lat. and $87^{\circ} 8' 26''$ W. long. only about 20 mi. east of the Illinois boundary, a total shift to the westward since 1790 of approximately 583 miles and southward of about 13 miles.

For further details see the article POPULATION OF THE UNITED STATES, CONTINENTAL, and the sections on Population in the articles on the several states.

Occupations. According to the Census of 1930 there were in the United States 98,723,047 persons 10 years old or older, of which 48,832,589 or 49.5% reported a gainful occupation. The number of gainful workers in the major groups of industries and in various representative subdivisions of these groups is set forth in the following table:

GAINFUL WORKERS, UNITED STATES, 1930

Industrial Group or subdivision	Total	Male	Female
ALL INDUSTRIES	48,832,589	38,053,795	10,778,794
AGRICULTURE	10,482,323	9,568,347	913,976
Farmers	6,017,722	5,760,050	257,672
Farm wage workers ..	2,727,035	2,555,935	171,100
MANUFACTURING AND ME- CHANICAL INDUSTRIES ..	14,317,535	11,901,247	2,416,288
Building industry	2,561,541	2,526,094	35,447
Chemical industry ...	621,050	534,672	86,378
Tobacco factories	149,652	71,024	78,628
Clothing industries ...	789,311	375,386	413,925
Bakeries	282,105	241,645	40,460
Packing houses	164,383	143,725	20,658
Automobile factories ..	640,161	594,889	45,272
Automobile repair shops	257,746	253,769	3,977
Iron and steel indus- tries	2,385,006	2,253,765	131,241
Other metal industries	331,790	276,531	55,259
Shoe factories	271,329	172,083	99,246
Saw and planing mills	454,241	444,160	10,081
Woodworking and fur- niture	405,695	369,350	36,345
Printing and publishing	541,761	427,187	114,574
Cotton mills	422,401	261,914	160,487
Silk mills	175,889	90,545	85,344
Knitting mills	174,028	72,476	101,552
Other textile mills ...	415,113	266,411	148,702
Electrical machinery ..	378,514	295,834	82,680
Rubber factories	166,431	130,762	35,669
TRANSPORTATION AND COM- MUNICATION	4,438,605	3,990,875	447,730
Construction of streets and roads	452,947	448,706	4,241
Garages	423,975	408,934	15,041
Postal service	284,063	254,238	29,825
Steam railroads	1,583,346	1,526,631	56,715
Street railroads	195,810	189,010	6,800
Telegraph and telephone	578,363	267,079	311,284
TRADE	7,537,026	5,820,642	1,716,384
Banking and brokerage	624,961	459,120	165,841
Insurance and real estate	798,285	564,381	233,904
Automobile agencies ..	505,322	472,120	33,202
Wholesale and retail trade	5,349,432	4,121,685	1,227,747
PUBLIC SERVICE	1,057,904	934,581	123,323
PROFESSIONAL SERVICE ..	3,425,844	1,663,049	1,762,795
DOMESTIC AND PERSONAL SERVICE	4,812,098	1,662,707	3,149,391
Hotels and restaurants	1,352,462	692,166	660,296
Laundries and cleaning	419,090	213,042	206,048
FORESTRY AND FISHING ..	270,125	266,876	3,249
Forestry	195,951	193,433	2,518
Fishing	74,174	43,443	731
EXTRACTION OF MINERALS	1,158,064	1,147,770	10,294
Coal mines	691,507	688,660	2,847
Oil and gas wells	198,955	195,006	3,949
Other mines and quar- ries	267,602	264,104	3,498

For additional details see the section Occupations in the articles on the states of the Union.

Outlying Possessions. The outlying possessions of the United States have a total area of 711,606 sq.

mi., not including 99 small ungoverned islands located throughout the Pacific and in certain sections of the Atlantic. Their total population approximates 14,233,000 inhabitants. They come under the two classifications, territories and dependencies.

Territories: Alaska, located in the northwest portion of the continent of North America, has an area of 586,400 sq. mi. By the treaty of Mar. 30, 1867, it was purchased from Russia and was made a territory by Act of Congress, Aug. 24, 1912. Pop., 1930, 59,278. Hawaii, a group of some 20 islands, of which 9 are inhabited, with a total area of 6,407 sq. mi., is located in the North Pacific about 2,000 mi. southwest of San Francisco. The islands were acquired July 7, 1898 by a treaty of annexation between the United States and the Republic of Hawaii. Pop., 1930, 368,336.

Dependencies: Philippine Islands, a group of islands in the Malay Archipelago, having a total area of 114,400 sq. mi., were ceded to the United States by the Treaty of Paris, Dec. 10, 1898, following the Spanish-American War. Est. pop., July 1, 1929, 12,082,366. Porto Rico, an island in the Greater Antilles, was ceded to the United States by Spain, Dec. 10, 1898. With certain small islands which are included in the territory, it has a total area of 3,435 sq. mi. Pop., 1930, 1,543,913. The Virgin Islands of the United States, a group of islands in the West Indies having an approximate area of 133 sq. mi., were purchased from Denmark, Jan. 25, 1917. Pop., 1930, 22,012. Canal Zone, a strip of land approximately 10 mi. wide and with an area, land and water, of 549 sq. mi., extending across the Isthmus of Panama, was acquired from Panama by a treaty of Nov. 18, 1903. Pop., 1930, 39,467. American Samoa, a group of islands totaling 76 sq. mi., is located in the South Pacific approximately 4,000 mi. southwest of San Francisco. The islands were taken over by the United States in 1900. Pop., 1930, 10,955. Guam, an island in the Pacific, ceded to the United States by Spain, Dec. 10, 1898, has an area of 206 sq. mi. Pop., 1930, 18,509. Wake, an island located on the route between Hawaii and Hong Kong, was claimed for the United States, July 4, 1898. It has an area of about one sq. mi. The Midway Islands, having an area of 28 sq. mi., are located in the North Pacific about 1,200 mi. northwest of Hawaii. Pop., 1930, 36.

The Philippines, Porto Rico and the Canal Zone are under the jurisdiction of the War Department; Samoa, Guam and Midway, under the Navy Department; and Alaska, Hawaii and the Virgin Islands, under the Department of the Interior. All have governors appointed by the President of the United States.

UNITED STATES OF AMERICA, HISTORY OF. Discovered by Viking adventurers whose attempts at colonization were thwarted by Indian hostilities, in the 11th century, the mainland of the North American continent was again made known to Western Europeans as the 15th century ended. After voyages of exploration and discovery had stimulated the curiosity and cupidity of the monarchs of Spain, France and England, a period of state-sponsored exploitation

and settlement began. Three rival empires: the Spanish from the south and southeast, the French from the northeast, and the English from the Atlantic seaboard, expanded toward the heart of the continent. The period of rivalry reached its climax in the FRENCH AND INDIAN WAR of 1754-63; but when the British Government attempted to consolidate its gains, to reconstruct its continental possessions into a dominion strictly subordinate politically to the British Crown and Parliament and restricted commercially for the benefit of English merchants and manufacturers, agitation and protest arose which led to the cleavage of the British Empire in America and the birth of the United States. A glimpse at the history of the British colonies along the Atlantic seaboard is therefore a necessary prologue even to a summary résumé of United States history.

The Colonial Era. Of the 2,600,000 settlers in the THIRTEEN COLONIES in 1776, the overwhelming majority were Englishmen. The non-English stock with the greatest representation in the colonies, and the largest influence on the development of the nation-to-be, was the Scotch-Irish, which formed the vanguard of the pioneers' march away from the coastal plain into the Appalachian valleys and thence westward into the Mississippi basin. Other elements which diversified American life included the Swedes and the Dutch, who had established fur-trading and agricultural colonies on the Delaware and the Hudson in the decade in which the foundations of Massachusetts Bay Colony were laid; Huguenots from France; Anabaptists from Hungary, Bohemia, and the German States; Calvinists from the Rhenish Palatinate; sprinklings of Welshmen, Finns, Poles and Sephardim. The New England colonies had fewest non-English settlers; the Middle colonies, largely because the proprietors of Pennsylvania and the Jerseys had advertised widely for colonists, possessed the largest share. These elements, because of common experience in Europe of the discomforts of being nonconformist, and because they were essentially identical with the English in their dislike of restrictions of any sort imposed by a distant sovereignty, were readily assimilated, and underwent with the English the leavening influence of the frontier. English common law, traditions of English political evolution, a stubborn insistence upon "the rights of Englishmen" as in the regime of the first Stuarts long after constitutional history in England itself had materially modified those rights, characterized the colonies as surely as did use of the English language.

Points accessible to ocean-going ships, the James River peninsula, Manhattan Island, Boston Bay, etc., were the nucleus of the first stage of colonial development. Thence settlement advanced upstream, rather than spread into roadless wilderness; but when traders' posts were built at the falls where the Atlantic streams emerged from the Piedmont, settlement expanded from these points wherever the land invited. Agriculture was the predominant activity, with the fisheries and fur trade ranking in order. In varying but important

UNITED STATES OF AMERICA



1. COURTESY MUSEUM OF FINE ARTS, BOSTON, MASS.; 2. THOMAS JEFFERSON MEMORIAL FOUNDATION; 3. 5. 6. 9. 10. LEET BROS. PHOTOS;
8. COURTESY METROPOLITAN MUSEUM OF ART

PRESIDENTS OF THE UNITED STATES, 1789-1845

1. George Washington, 1789-93; 1793-97. 2. John Adams, 1797-1801. 3. Thomas Jefferson, 1801-05; 1805-09. 4. James Madison, 1809-12; 1812-17. 5. James Monroe, 1817-21; 1821-25. 6. John Quincy Adams, 1825-29.
7. Andrew Jackson, 1829-33; 1833-37. 8. Martin Van Buren, 1837-41. 9. William Henry Harrison, March 4-April 4, 1841. 10. John Tyler, April 4, 1841-45.

degree the maritime interests of New England, the Indian trade of Albany and Charles Town, the tobacco plantations of Virginia, the wheat raising and horse breeding of Pennsylvania, in fact all forms of colonial economy except the self-sufficient agrarian life of the frontier, were dependent upon trade and navigation acts in which colonial welfare was arbitrarily assumed to fit neatly into a grand pattern designed to glorify the British manufacturer, the British merchant marine, and the British Exchequer. These regulations were made by King, Parliament, Privy Council, commissions and committees, whatever body happened, in the changing course of English history, at the moment to wish and to be able to dictate colonial policy. Archetypal of these regulations was the Navigation Act of 1660, which added to provisions for the securing of British commerce to British ships, aimed at the carrying trade of the Dutch; a list of "enumerated products," including sugars, tobacco, cotton-wool, indigo, fustic and dye-woods, which could be exported only to England or to other colonies of England. Although the British mercantile policy embraced bounties and remission of duties to encourage in the colonies production of certain materials for which England was then dependent upon foreign countries, the saving grace from the colonial viewpoint was the laxity of enforcement. In 1651, 1661 and 1681 England threatened political and economic supervision of some vigor; but in each instance domestic exigencies diverted attention from the colonies. Under George III the trade and navigation system was for the first time vigorously, even stringently, enforced; the result was revolution.

Although 158 years separated the founding of the first permanent settlement and the outbreak of revolutionary agitation, England had not attained effective political control of the colonies. The charters under which the several colonies had been founded generally conferred extensive powers upon the proprietors or inhabitants; the provincial assemblies had weakened the authority of governors and judges appointed by the Crown by controlling the payment of their salaries. Self-direction was in fact imposed by the geographic factor of distance. When three months under the most favorable conditions were required for communication and answer to pass between colony and homeland, the veto power in London naturally lost most of its force. Congregational government in the parish vestries in England and Scotland was freed of its restrictions when Protestantism was transplanted to the new world, and became a great educative force toward democracy. The habit of local government in 17th century England blossomed in the next century along the Atlantic seaboard. In the expression of an eminent historian, "the colonies came to regard the lawful intervention of the king in their affairs like the unwarranted intrusion of a tyrant."

Frontiersmen, inclined to separatism by the very force of environment, had long defied agents of the Crown and the provincial proprietors to collect quit-rents, and regarded the King's proclamation of Oct. 7,

1763, setting a boundary (later traced by Sir William Johnson and John Stuart) at which the westward movement was to halt, as a vexatious restriction not to be respected. The same proclamation alienated land-speculators, many of them Virginia planters, who had claims to great tracts of wilderness along the upper Ohio. The QUEBEC ACT of 1774, shutting out the Pennsylvania traders from the Ohio valley to the profit of the Montreal traders, prepared frontiersmen for their part in the revolution. The grievances of the merchants: the use of WRITS OF ASSISTANCE, the STAMP ACT, the TOWNSHEND ACTS, the "INTOLERABLE" ACTS persuaded a naturally conservative class to favor radical measures, and inflamed the greater part of the population in the districts most oppressively affected. Premonitory outbursts, e.g., the BOSTON TEA PARTY and the SEIZURE OF LIBERTY may not have been popular in origin; but the perpetrators were shielded from British officers by a common conspiracy of silence. Rumbling discontent pervaded the class of debtors and small farmers, whose fundamental aim had been obscurely expressed in the PARSONS' CAUSE contest and in the REGULATION, NORTH CAROLINA: the removal of any force which denied political equality, whether an English bureaucracy or a privileged, office-dominating class in the colonies. Overriding diverse characteristics of the several colonies were common grievances, and a common experience in driving back the Indians from the path of settlement. Previous attempts at colonial union (*see* NEW ENGLAND CONFEDERATION; ALBANY CONGRESS; STAMP ACT) had been unsuccessful; but in the crisis forced by the Tory ministries of King George III the colonies established first an informal, advisory union (*see* CORRESPONDENCE, COMMITTEES OF), cooperated somewhat in the enforcement of NON-IMPORTATION AGREEMENTS, and finally in 1774 united in a "diplomatic body," the CONTINENTAL CONGRESS, which managed to exist as a unifying force throughout the REVOLUTIONARY WAR. By 1781 the English were convinced of the impracticability of trying to conquer a land of continental dimensions, and of the impossibility of holding the land without subduing it. Two years later (*see* PARIS, TREATY OF, 1783) the independence of the United States was formally acknowledged.

THE FORMATIVE YEARS, 1781-1800

Charters, State and National. When the Revolution removed the superstructures of provincial Government whereby economic sovereignty and the higher functions of diplomacy and of judicial control rested in London, the local legislatures became supreme. These bodies, effortlessly becoming "congresses" or "conventions," framed written constitutions of state government. Two states, Rhode Island and Connecticut, which as provinces had chosen their governors by popular election, protracted their old charters with slight alterations. The new documents reflected the old quarrels between locally controlled assemblies and royally appointed governors. Only two states provided that the executive should have any measure of

veto power, and frequent gubernatorial elections, annually in nine states, further ensured the supremacy of the legislature. Judges were appointed and were subject to removal by the legislature. The typical constitution was prefaced by statements of "natural rights," declaring Government a "social compact" made by the people voluntarily for the common good. Yet radical democracy was not established; compromises of the agrarian debtor elements with the moneyed and "well-born" were evident in the restrictions hedging suffrage and in the qualifications for officeholders. Three states, Pennsylvania, New Hampshire and Georgia, required a voter to be a taxpayer; the other 10 set property qualifications. The upper house of the legislature was in a sense reserved for men of property; but on the other hand the new constitutions provided for numerical increase in the property holding class by abolishing feudal tenure for the most part, in four instances prohibiting the entailment of estates, and in Virginia prohibiting primogeniture. The general Government which in Mar. 1781 superseded the Continental Congress was little more than a league of friendship because of agrarian antipathy to centralization of authority and because the possessors of landed property, the scholarly leaders of politics in Virginia for instance, were still preoccupied with the new-born consciousness of state sovereignty and did not yet perceive how nearly their interests were allied with those of the well-to-do merchants. Yet the ARTICLES OF CONFEDERATION were a notable contribution toward workable national unity, despite that a central Government without economic sovereignty and without coercive powers found its usefulness restricted in almost every respect.

Economic Disintegration. Labor and capital diverted from agriculture and legitimate commerce to manufactures and privateering underwent painful readjustment following the peace. The influx of European manufactured goods overwhelmed the "infant industries" born during the war; the Carolinas and Virginia had been too well ravaged by British troops to recover quickly, and were bereft of thousands of slaves transported by the British and Loyalists; the reabsorption of the disbanded army into peacetime pursuits was a slow, uncertain process. Commercial privileges extended by European nations during the conflict were withheld when the United States was a nation; Sweden, 1783, and Prussia, 1785, were the only nations with which treaties guaranteeing reciprocal commercial privileges could be made. Each of the great nations had its own colonial system, its own set of navigation acts; its discriminations operated against the new nation as against the others. The British mercantile system, however galling to colonists within that commercial sphere, proved newly onerous after 1783; owing to the unfavorable balance of trade the large amount of specie in the country was rapidly drained away, mostly to England. JOHN ADAMS spent three years in London, 1785-88, in a fruitless endeavor to negotiate a treaty of commercial amity. Because each state could levy tariffs and tonnage duties, a

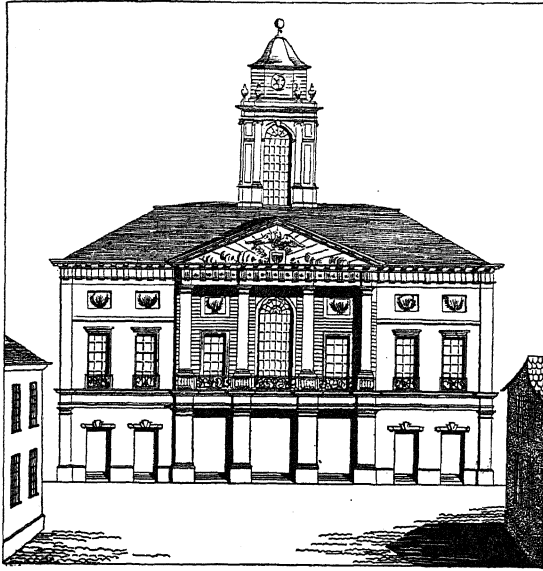
variable scale of protection simply directed European goods to the ports of states levying light duties or none. By 1785, however, "Yankee" ship-owners were setting the pace for the rapid economic and social evolution of the nation in the next decade. Through the neutral islands, so useful during the war, illicit trade in British products developed large proportions; the French Government, at the intercession of its own colonial citizens, admitted American ships into important ports in the West Indies; the number of American vessels entering British West Indian harbors under false registration papers made the English restriction practically a dead letter.

Yet the quantity of paper money in the states caused a marked increase in prices. The diversity of currency, somewhat remedied by the adoption of a system of coinage by Congress in 1786, hampered trade; unemployment was widespread, and prisons were clogged with debtors. Agrarians and maladjusted elements in the towns inclined to a radical remedy, issues of unfunded paper money, fiat tender to be forced upon merchants and creditors by the weight of law. The conservative check upon the legislatures, mostly through dominance of the upper house, was put to the strain of clamorous opposition: in Massachusetts, SHAYS'S REBELLION; in New Hampshire, a mob about the capitol which had to be dispersed by the militia. Seven states yielded to the demand. GEORGE WASHINGTON voiced the conviction of the conservatives in writing, "There are combustibles in every state which a spark might set fire to." Heading the POTOMAC COMPANY, and having extensive land-holdings in the West, Washington represented the new unity of interests of three overlapping groups: planters, merchant-capitalists, officers of the Revolution. These groups, whose economic interests were most seriously affected by the absence of a general Government with sovereign power, and fearful that the rights of property would be inundated in the rising tide of uncontrolled democracy, provided the initiative, ability and constructive labor which produced the permanent charter of our National Government (*see CONSTITUTIONAL CONVENTION; CONSTITUTION, UNITED STATES*).

The Federalist Era. As JAMES MADISON stated in the 10th of *The Federalist* papers, the fundamental problem of the Constitutional Convention had been "to secure the public good and private rights against the danger" of factional government by the propertyless masses "and at the same time preserve the spirit and form of popular government." A National system to that purpose was of course bitterly opposed by certain democratic elements. The prevailing political philosophy was individualistic; stressing personal liberty, it regarded with disfavor strong Governments, because they might become oppressive. A large debtor element desired to avoid taxation. A centralized Government, it was widely feared, would give rise to a ruling aristocracy. But when on June 21, 1788 New Hampshire ratified the Constitution, nine state conventions had approved the document, and the new system could then go into effect. Within a few weeks

Virginia and New York entered the compact by narrow majorities, 10 and three respectively; these two and three other states made their action conditional on the addition to the Constitution of a BILL OF RIGHTS, similar to the preambles of the state constitutions, affirming the natural rights of man which Government should not transcend. The first 10 amendments satisfied this demand. North Carolina and Rhode Island reluctantly ratified the Constitution after the new Government had been established.

George Washington, unanimous choice of the first Electoral College, was inaugurated President at Fed-



COURTESY M. N. OF ART

FEDERAL HALL, NEW YORK

eral Hall, New York, Apr. 30, 1789; Congress, already in session, endowed him with the nucleus of a Cabinet, and both executive and legislative branches set about the tasks of fundamental organization. Almost nothing except the post-office system was inherited from the Confederation. The first Congress enacted an elaborate system of Federal courts, and a tariff. One of its last acts was to request ALEXANDER HAMILTON, Secretary of the Treasury, to prepare a report on the state of the finances. Four elaborate documents, presented to Congress in 1790-91, embodied the Hamiltonian program. The entire national debt, about \$56,000,000, was to be refunded at face value; the Revolutionary obligations of the states, about \$19,000,000, were to be added to the debt carried by the National Treasury; a sinking fund established by Congress was eventually but unhurriedly to absorb the indebtedness; a National bank should be established in which the Government and private investors were to be stockholders; the tariff was to become protective; an excise was to be levied on distilled liquors, as much to bring the power of Government into the backwoods as for revenue. The import of these measures was to identify the interests of American business enterprise with the perpetuation of the new Government by augmenting

the fluid capital of the country with guaranteed public securities and furnishing currency, credit, and protection against foreign competition. All features of the program save the protective tariff were enacted, and, complemented by provisions for a mint and a coinage system, laid a permanent foundation for strong national authority. The triumph was at the price of political cleavage into two irreconcilable factions, the FEDERALISTS and Democratic-Republicans. (See DEMOCRATIC PARTY.) THOMAS JEFFERSON, who opposed all centralizing tendencies of the Government, was the natural leader of the latter faction. By the end of the first Presidential term political opinion was well crystallized; by the end of the second, definite party alignments had become a major characteristic of the nation's political life.

John Adams, whose Presidential term from 1797-1801 completes the Federalist era, was one who favored "government by an aristocracy of talents and wealth," and resembled his leading opponent, Jefferson, in no respect but partisan intractability. Adams retained Washington's Cabinet, which had become wholly Federalist; but with the strongest figure in the party personally unfriendly to Adams, cross-purposes within the organization deprived the President of opportunity to leave a record at all commensurate with his genuine abilities. The Congressional measures to enforce respect for public officials which proved disastrous for the party in power were, however, in line with the views of both Adams and Hamilton. The viciousness of the Jeffersonians' attack upon the Administration assumed an international aspect when relations between the United States and France became unfriendly. Journalists of French birth were conspicuous among Democratic-Republican partisans. An extension of the time requirement for naturalization to 14 years and provision for exile or imprisonment of "dangerous" aliens by Presidential order in time of war seemed reasonable legislation when war was imminent; but the emphatic disapproval voiced in the VIRGINIA AND KENTUCKY RESOLUTIONS heralded the rejection of government by "wealth and talent" in the Presidential election two years later. Against Adams's 65 electoral votes, Jefferson and his running-mate, AARON BURR, each received 73. Each elector voted twice, it will be remembered, the constitutional provision being that the highest candidate should be declared President, the next highest Vice-President. This awkward arrangement had resulted in 1796 in the naming of Jefferson as Vice-President under his political opponent; its effect in 1800 was to throw the election to the House of Representatives, which chose Jefferson after 36 ballots. The 12th Amendment, adopted in 1804, revised the procedure of choosing the two executive officers to avoid repetition of the confusion.

International Recognition. The first Congress provided the President, assigned direction of foreign affairs by the Constitution, with a Secretary of State who became in effect foreign minister. Throughout the Federalist period external problems were of such moment that the whole Cabinet, in early years with

the Chief Justice and the Vice-President also present, discussed and outlined foreign policy, Jefferson's views frequently being overruled. Unable to fill diplomatic posts with men of the requisite calibre, the Government adopted the practice of sending missions for important negotiations. Relations with England promised the greatest difficulty; prospects of war between England and Spain over Spanish interference with British trade on the northwest coast of America produced uncertainty and diverse opinions among the Cabinet over the attitude of the United States in the contingency that her territory be invaded. British troops yet occupied posts south of the Great Lakes despite the *TREATY OF PARIS*, 1783, nor were they withdrawn until 1796. Discriminating duties against British shipping were strongly urged by Jefferson to evoke a relaxation of British restrictions upon American vessels, but were rejected by Congress. When England and France became involved in war in 1793, however, it was the latter nation which offended the American Government. With high hopes of drawing the United States into the war as an ally because of the common bond of republicanism, the indebtedness of the Revolutionists to French aid, and the unrestrained Francophilism of Jefferson and his followers, the newest republic sent to the United States a diplomatic representative (*see GENET'S MISSION*) who supported the separatist movement in the West and otherwise gave affront to American sovereignty. His activities induced Washington to issue his famous *Neutrality Proclamation*. Jefferson, torn between two loyalties and rabidly distrustful of Hamilton's influence in the Administration, resigned; EDMUND RANDOLPH became Secretary of State.

In that year, 1794, the interference of British war vessels with American commerce with the French West Indies, enforcing broad British-made definitions of contraband and blockade, and characterized by the twin evils of *IMPRESSMENT AND SEARCH*, inflamed American opinion against England and threatened to force the Administration to adopt a belligerent policy of retaliation. The Senate, however, acted as a conservative lever upon the House: a general embargo was enacted, first steps were taken in the construction of a navy, and JOHN JAY was sent to England to demand an end of the abuses. The *JAY TREATY*, a comprehensive document, effected a compromise of the difficulties arising out of the treaty of 1783, provided for adjudication of many points at issue by special commissions, and extended commercial concessions to the United States, but failed to force recognition of the American position on the limits of blockades and of search and seizure, leaving open the channel of controversy which led to the *WAR OF 1812*. The Spanish court, interpreting the treaty as the beginning of an alliance of the English-speaking nations against France and Spain which would rob the aging empire of Louisiana and Mexico, reluctantly treated with THOMAS PINCKNEY, special envoy to present the American aspect of the many issues between the two countries (*see SPAIN, TREATY WITH*, 1795). Govern-

ment under the Constitution had, in effecting these two desirable treaties which the Confederacy could never have negotiated, justified itself to the American people.

Holding that the failure of the United States to maintain its full neutral rights against England constituted a practical alliance with the enemy, France dispatched an agent into the American West to further the possibility of dismemberment of the United States, and began negotiations for the repossession of Louisiana from Spain. Two overt occurrences, the refusal to receive CHARLES C. PINCKNEY as minister from the United States and the seizure and condemnation of American vessels under unjustifiable decrees, prompted President Adams to dispatch to Paris a joint commission. Bribery was apparently the only method, however, by which peace could be obtained (*see X Y Z MISSION*); and on June 12, 1798 Congress ordered commercial intercourse with France suspended. On July 8 naval vessels were authorized to capture any armed French vessels (practically all French merchantmen were armed), and Adams was authorized to commission privateers. The naval war which ensued was welcomed by Hamiltonian Federalists, but was not what the French minister of foreign affairs, CHARLES MAURICE TALLEYRAND, had desired. Talleyrand on Sept. 28 informed the American minister at The Hague that France would receive any minister whom the United States might send, with the respect due the representative of "a free, independent, and powerful nation." Adams accepted the overture; on Sept. 30, 1800 a convention was concluded at Paris (the American commissioners being William Vans Murray, W. R. Davie and OLIVER ELLSWORTH) generally satisfactory on points relating to navigation, and renouncing both the French demands for the execution of previous treaties with the United States and American demands for indemnity for illegal confiscations of ships and cargo. Washington's policy of neutrality was still intact, and now relieved of treaty complications.

Westward Expansion. As the plantation owners of the colonial South accumulated surplus wealth, they turned, often in combination with English capitalists, to grand projects of colonization and Indian trade in the American West. Virginia, which by virtue of its charter claimed a breadth of 200 miles "west and northwest" to the sea, between 1745 and 1754, conferred through its governor and council 34 grants of land. The *OHIO COMPANY*, with a royal charter, came nearer success than most; but the actual settlement of the trans-Appalachian regions remained for Scotch-Irish families and truculently independent frontiersmen who paid little attention to land titles. The Revolution blighted the *VANDALIA* project before fruition. The colonizing expedition organized by the *Transylvania Company* (*see TRANSYLVANIA*) which, preceded by DANIEL BOONE, followed the *WILDERNESS ROAD* and laid the foundations of Kentucky, shook off the proprietors' overlordship before the Revolution was well under way. The settlement

on the Watauga River remembered for its self-devised constitution, the WATAUGA ARTICLES, was a more characteristic development of the frontier. Reduced to fundamental techniques in the processes of working and living by the primitiveness of their physical environment, frontiersmen remeasured conventional institutions in the light of the useful and the natural, and became apostles, in action rather than in coherent thought, of democratic simplicity. Localized rather than centralized Government, an unrestricted franchise, and a wealth of constitutional restrictions to guard against the diversion of government from the will of the majority, were political demands of the back-country. Intolerant of the Indians and eager for adequate channels of communication, the frontier succeeded in forcing its demands upon the nation.

Seven of the states had claims to western lands founded upon the terms of their colonial charters; Maryland led the unendowed states in demanding, successfully, relinquishment of these claims to the central Government. The guardianship of these lands gave the Congress of the Confederation its greatest dignity. All the western lands south of the Potomac, except certain Indian reservations, were private property at the time of cession; but north of the Ohio was public domain. Enactments for the surveying and sale of this domain, the ORDINANCES OF 1784, 1785 and 1787, were the most important legislation of the old Congress, and set models which became the foundation of the public lands policy of the United States.

Vermont, sector of a remote frontier, became a state in 1791; Kentucky, the strongest western community, attained statehood in 1792, and Tennessee four years later. But while Spanish control of the western bank of the Mississippi and of both banks at the mouth hindered the transportation of western produce dissatisfaction prevailed, and the possibility of an independent state in the Mississippi valley or of the northeastward extension of Spanish influence alarmed both Federalists and Jeffersonians. The WHISKY REBELLION and FRIES' REBELLION suggested that opposition to a centralized Government might enlist the small farmers in the older states as well. The LOUISIANA PURCHASE, although perhaps a lucky accident, proved the needed element to bind the West to the National Government.

FROM JEFFERSON TO JACKSON, 1800-29

The Growth of Nationalism. Endeavoring to lessen the influence of Jeffersonianism by stocking the civil service with Federalists, President Adams in the last month of his term sent over 200 nominations to the Senate. Commissions not yet delivered when Jefferson became President were pigeonholed. The petition of one appointee for a mandamus for the delivery of his commission was denied by the Supreme Court (*see* MARBURY vs. MADISON); but the chief constitutional import of the decision by Chief Justice JOHN MARSHALL was the annulment of an act of Congress. The YAZOO CLAIMS muddle gave rise to a decision (FLETCHER vs. PECK) in 1810 annulling an act

of a state legislature. In two notable cases of the next decade, M'Culloch vs. Maryland and the DARTMOUTH COLLEGE CASE, the political and economic significance of Marshall's philosophy was reemphasized: that the popular will, as expressed in Congressional legislation, must observe the restraints of the Constitution; that "state sovereignty" did not hold legislative acts immune from review by the Federal Supreme Court, and that the National Government was predisposed to favor the rights of property. Marshall was in fact molding the Constitution in a permanently conservative cast while the Government was still plastic, shaping a system of centralized authority at variance with the loose principles of JEFFERSONIAN DEMOCRACY. Efforts of the Administration to strike back were ineffectual; a Federal District judge in New Hampshire was impeached and removed in 1803; but the violently Federalist Judge Samuel Chase of the Supreme Court was acquitted by the Senate when no more effectual charge than partisanship could be demonstrated.

The irresistible force of westward expansion was also potent in advancing the supremacy of the National Government, even though the Democratic West voted consistently Republican rather than Federalist. Ohio, the first state to be created out of the public domain, was admitted to the Union in 1803. It was the anomalous rôle of the Jeffersonian Administration in that year to permit public-domain states, in which state sovereignty was a gift of Congress, in time to outweigh the original 13, in which state sovereignty was a historical fact, by virtue of the purchase of Louisiana from France. This domain, from the Gulf of Mexico to the 49th parallel and from the Mississippi to the Rockies, at the time seemed valuable chiefly for the benefit to Western commerce of an all-American Mississippi; but Federalist leaders understood that the purchase guaranteed the success of the Democratic revolution, and some hoped that the New England states as the only means of preserving aristocratic traditions would secede from the Union. The LEWIS AND CLARK EXPEDITION into the Far West, the expedition of ZEBULON M. PIKE to the upper waters of the Mississippi, and explorations of the Red River and its tributaries tended to bring the new frontier closer to the nation; while a filibustering movement of undiscoverable dimensions, involving AARON BURR, Gen. JAMES WILKINSON, and many leading Westerners, collapsed after Jefferson pronounced the enterprise treasonable. The State of Louisiana entered the Union in 1812. The steamboat made its first appearance in the Mississippi River system the previous year, to become like the CONESTOGA WAGON of the CUMBERLAND ROAD a link in interstate traffic binding the Union into an unbreakable unit.

The Treasury and the State. ALBERT GALLATIN was Secretary of the Treasury throughout Jefferson's two terms in the Presidency, 1801-09, and for five years of the tenure of Jefferson's successor, JAMES MADISON. Heartily committed to the Democratic-Republican Party principle of financial retrenchment,

Gallatin in his first report to Congress advocated reduction of the army, cessation of the construction of war vessels, discontinuance of diplomatic establishments in countries whose relations with the United States were entirely amicable, steady curtailment of the foreign debt toward its elimination within 16 years, and abolition of the excise tax. With Jefferson's support the program was enacted; but demands of westward expansion and international policy forced successive compromises with the theory of economy, so that a budgetary surplus of nearly \$3,000,000 in Gallatin's first year became a deficit of \$1,300,000 in the year 1809. The BARBARY WARS forced upon the nation extraordinary naval expenditures; the Louisiana Purchase required a bond issue; strained relations with France and England over the abuse of the blockade as an instrument of the war between these two nations and over the impressment of American seamen by British ships led in 1807 to increased expenditures for National defense. Jefferson further disturbed financial security by persuading Congress to follow alternate policies of non-importation of manufactured goods and of closure of American ports to all but coastwise shipping. (See NON-INTERCOURSE ACTS.) Commerce, in New England especially, languished while successive offenses by Great Britain against American dignity, e.g., the CHESAPEAKE-LEOPARD AFFAIR, brought the United States to the brink of war.

Jefferson's policies rested upon the belief that American commerce was indispensable to both belligerents, and that depriving them of American products was the most promising method to secure from England and France observance of American rights on the high seas. Domestic opposition made impossible the strict enforcement of any embargo, however; the Federalist Party gained strength in New England as the closure of the ports affected price levels and as legislation became increasingly oppressive in a vain attempt to check leakage of food products, potash and lumber across the Canadian border. In 1804 the Federalist candidate, C. C. Pinckney, had mustered but 14 votes against Jefferson; in 1808 all the New England states except Vermont returned to the Federalist fold, and Pinckney received 47 votes against Madison's 122. Previously Secretary of State, and Jefferson's own choice for the succession, Madison proposed to continue the policy of passive resistance toward British aggression (the international equation had been simplified by the complete defeat of Napoleon's naval forces); but the new President was inept in party leadership, as in his private finances, and abandoned his first judgment to follow the WAR HAWKS of the Congress of 1811-13. The War of 1812, "unnecessary, untimely, and rash," was bitterly opposed in New England, to the political advantage of the Federalist Party until rumors of treasonable discussion in the secret sessions of the HARTFORD CONVENTION discredited the party leaders. But this regional opposition was probably less a handicap to the Administration than its own follies. Although

the petition of the United States Bank for renewal of its charter was endorsed by Gallatin, partisan distrust of the "Federalist invention" was such that the bill for renewal was defeated in the Senate, Feb. 20, 1811, by the deciding vote of the Vice-President, GEORGE CLINTON. When war began the funds of the nation were distributed among 21 local institutions, and no central bank existed to assist in exigent financing. Gallatin could not make up his mind as to the desirability of internal taxation as a war-time measure until it was too late to educate Congress to enact adequate taxation measures. Nor was Gallatin, his influence weakened by factional opposition throughout Madison's Administration, the apt pedagogue.

Treasury notes were issued in six series; the denominations of the last two series ranged as low as \$3, but a note of less than \$100 was non-interest bearing. At the close of the war the notes yet outstanding were funded into interest bearing bonds. Public credit was the chief reliance of the Treasury during the war; but loans were placed at very disadvantageous terms. For loans of over \$80,000,000, 1812-16, the Treasury received a specie equivalent of only \$34,000,000. Internal taxation was adopted only at the insistence of the Administration when Congress was called in special session, in the summer of 1813; Congress enacted a direct tax, laid duties on carriages, refined sugar, the holding of actions, and imposed several stamp and license taxes. In Sept. 1814 these several taxes were increased and new duties on certain manufactured articles were added. ALEXANDER J. DALLAS, Secretary of the Treasury after Oct. 1814, secured the establishment of the Second United States Bank too late to aid in the emergency. "Peace without victory" was welcomed by Government and people alike. See GHENT, TREATY OF.

Party Cleavage Under Monroe. With the prior problem of the status of the United States among nations disposed of by the generation of statesmen which had fought in the Revolution and framed the Constitution, the new generation worked to make the nation economically self-sufficient. Essentials in the program were listed in Madison's annual message of Dec. 5, 1815: improved organization and increase of the peace-time status of the army and navy, the enlargement of the existing Military Academy and the founding of similar institutions, the creation of a national currency, the protection of manufactures, the construction of roads and canals. The new tariff and the establishment, also in 1816, of the Second United States Bank, chartered for 20 years, of which the Government subscribed one-fifth the capital and was commensurately represented in the directorate, were evidences that the Democratic-Republican Party had become a strongly National party, and that the old basis of political partisanship was no longer existent. The only serious opposition to the succession of JAMES MONROE, Madison's Secretary of State, to the Presidency, was distrust within the party of continued domination by Virginia and New York politicians.

The Federalist candidate, RUFUS KING, received but 34 electoral votes. King privately spoke of his candidacy as a "hopeless struggle"; in 1820, indeed, King's party had disappeared, and when Monroe was reelected without opposition the times seemed, superficially, an era of good feeling.

Monroe's aim in 1817 was to embrace the most influential statesmen within his cabinet, to close avenues of disruption by giving these leaders a share in the Administration. JOHN QUINCY ADAMS became Secretary of State. WILLIAM H. CRAWFORD, Monroe's dangerous rival in the party caucus of 1816, continued as Secretary of the Treasury. JOHN C. CALHOUN was named Secretary of War, and WILLIAM WIRT, Attorney-General. HENRY CLAY astutely refused an appointment, preferring to remain Speaker of the House and lead the opposition certain to develop. Clay in 1817 attempted to embarrass the Administration by demanding recognition and assistance for the Latin-American republics then painfully emerging from the ruins of the Spanish colonial empire, and in 1818 by censuring Gen. Jackson's (*see* JACKSON, ANDREW) invasion of Florida when that fiery Westerner protracted the SEMINOLE WARS into Spanish territory and summarily court-martialed and executed two British citizens whom he accused of fomenting the Indian uprising. The purchase of Florida (*see* SPAIN, TREATY WITH, 1819) removed that controversial issue; but in the next year the inescapable germ of controversy, slavery, fastened upon Congress. The debate in Congress which culminated in the MISSOURI COMPROMISE revealed a sectional division, South against North, with the prize of the contest, the Senatorial representation of the new states, to be carved from the public domain. The debates over Missouri's newly invigorated states-rights sentiment in the South, where many were voicing the opinion that since the slave labor of the South could not be used in manufacturing establishments the protective tariff inured solely to the benefit of the North. The acrimonious discussion revealed to the North the economic consequences of southern domination, and stimulated anti-slavery agitation. In Monroe's second term another event of far-reaching consequences, the promulgation of the MONROE DOCTRINE, demonstrated that the nation was a self-confident unit in international affairs, however its domestic unity might be threatened.

Factional Warfare, 1824-28. Jackson, Clay, Adams, Calhoun, Crawford and William Lowndes, aspirants for the Presidency in 1824, each attempted to belie the stature of merely "favorite son" by minimizing the interests of his particular section and presenting himself in generous ambiguities as a statesman of truly National views. After a season of prodigious electioneering, the electoral vote in November was 99 for Jackson, 84 for Adams, 41 for Crawford, 37 for Clay; Calhoun, who had concentrated upon gaining the Vice-Presidency after his native state had drifted toward Jackson, received 182 of the 261 electoral votes. The choice of President devolved upon the House, as the Constitution provides when the

electoral ballot does not reveal a majority. Clay, holding the balance of power, foresaw that his championship of the "American System" would in the forthcoming readjustment of parties provide himself with northern support; as an overture to the manufacturing states he threw his strength to the candidate from Massachusetts, Adams was elected, and Clay was expeditiously named Secretary of State. Jackson stormed against Clay as the "Judas of the West," and included Adams in his extensive list of personal enemies; MARTIN VAN BUREN, adding Crawford's old followers to his adherents in New York State to build a strong personal machine, made opposition to any Administration measure a matter of strict political policy. Calhoun used his position as president of the Senate to appoint committees hostile to Adams; and Adams, of strong intellectual gifts and preeminently qualified for his high office by integrity and experience, saw his program of impartial nationalism: internal improvements, a nationally organized militia, scientific and cultural measures for the general betterment of the citizens, flounder. The Erie Canal was formally opened shortly before Adams sent his first message to Congress; but he was not permitted to inaugurate any public work of the magnitude of that state enterprise.

When Adams nominated envoys to represent the United States at the Panama Congress of 1825, the opposition pointed to dire disaster awaiting the slavery states if the nation participated in a Congress in which Negro delegates from Haiti were recognized, and brazenly asserted that one purpose of the Congress was to lay plans for the liberation of Cuba and Porto Rico from Spain and from slavery. The injection of the slavery issue tended to bind the South to Jackson. When Adams interfered to protect the Creek Indians from a fraud tainted land cession, the Georgia legislature announced that the state was sovereign within its borders and proclaimed his action "illegal and unconstitutional"; a factious Congress left him in an embarrassing position. The controversy over the tariff was more serious. Since a severe panic in 1819 had marked the close of the post-war period of prosperity and over-optimistic speculation, business had become reestablished in two years; and during Monroe's second administration the capital invested in manufactures had increased over 60%, to \$160,000,000. Labor correlatively increased. Only about 6% of this capital and labor was in the six states of the "cotton belt." Protective tariff, accordingly, was fast becoming recognized as a sectional issue. When a comprehensive gathering of manufacturers at Harrisburg in the summer of 1827 forced Congress to consider a general revision upward of the tariff, the Jackson-Calhoun-Crawford opposition party was divided nearly equally between friends and enemies of protection, and sought a way out by framing a bill which should be satisfactory to the manufacturing interests of the Middle States, but offensive to the commercial interests of New England, forcing Adams by approval or veto to lose the support of one

of the sections. But the New Englanders declined to be offended. DANIEL WEBSTER, in voting for the bill, made evident that the long conflict between manufactures and commerce in New England was at an end. South Carolina assumed Southern leadership in protest at this TARIFF OF ABOMINATIONS; its legislature adopted an "exposition" written by Calhoun giving the opposition to protection and internal improvements a constitutional bias (*see* NULLIFICATION, RIGHT OF), and the state rested to await the election of Jackson in November and the vindication of southern interests. Jackson was duly elected, by a combination of the South and the central states, receiving 178 electoral votes to Adams's 83.

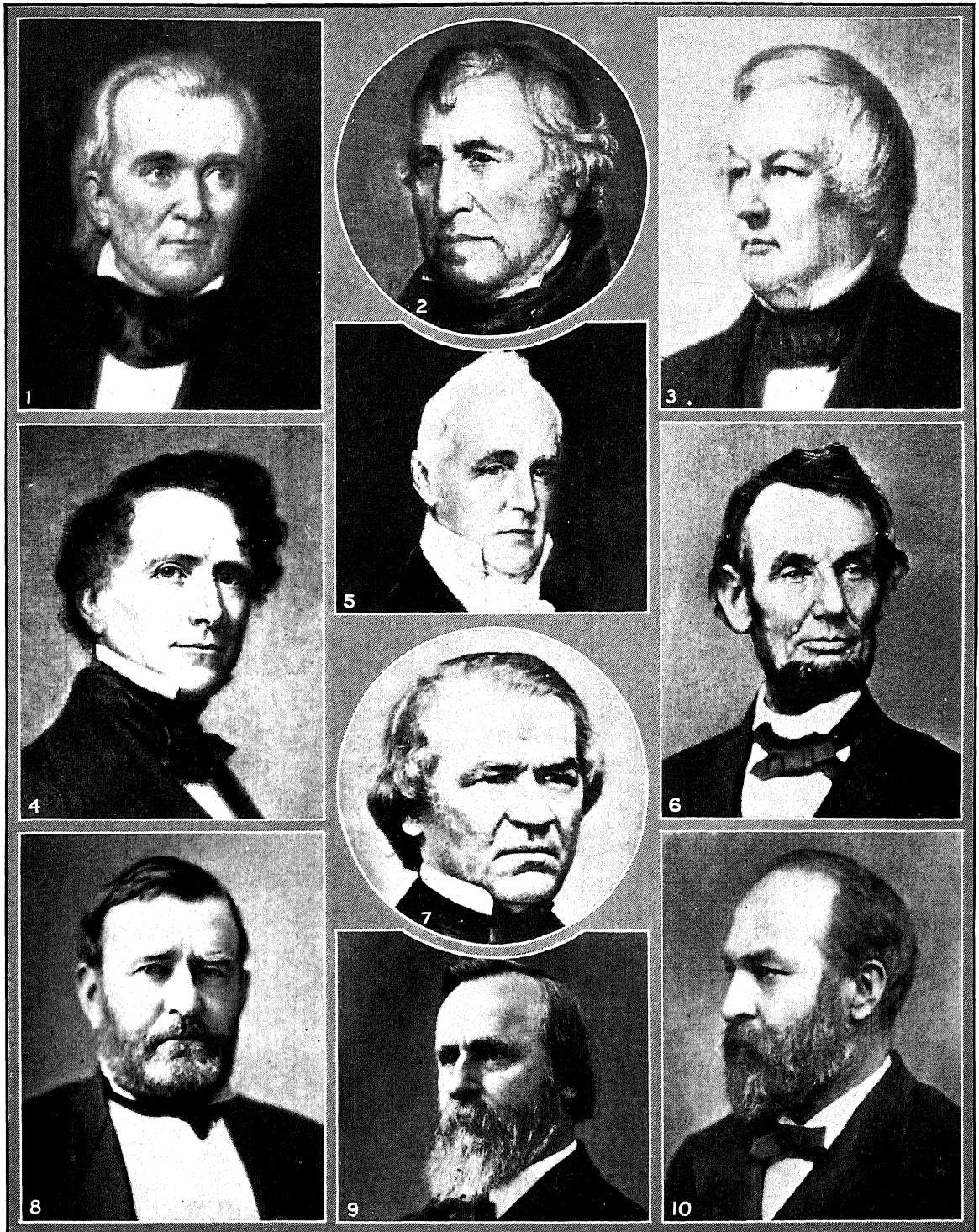
TOWARD SECTIONAL WARFARE, 1829-61

The Jacksonian Era. JACKSONIAN DEMOCRACY was the product of two lines of force: the frontier impetus toward ever-widening democracy, and the demand of the urban wage-earners for recognition, united under the imperious will of a partisan leader. The Cabinet, except for Van Buren, Secretary of State, counted for little with the President, since it perforce included several followers of his strange political bed-fellow Calhoun; Jackson preferred to consult a cabal of practical politicians, his KITCHEN CABINET, until a prolonged social tempest over the amenities due the lowly-born wife of his Secretary of War and personal friend, John H. Eaton, culminated in the resignation, by request, of the Calhounites and the reconstruction of the Cabinet with friends of Jackson and Van Buren. Until he accepted the ministry to England in 1831 as a strategic move, Van Buren was Jackson's daily companion, and was consistently his political mentor. The revelation that in 1818 Calhoun had proposed that Jackson be court-martialed for his conduct in Florida completed the breach between President and Vice-President. In 1832 Calhoun resigned the Vice-Presidency to enter the Senate as champion of the doctrines of state sovereignty and the right of nullification. The MAYSVILLE ROAD VETO, Jackson's toast at the Jefferson Birthday banquet of Apr. 13, 1830 ("Our Federal union, it must be preserved"), and his downright positiveness that the United States Bank was unsound, strengthened the President's appeal to the common man and insured his reelection in 1832. The Clay-Adams-Webster group, opposed to Jackson's policy of internal improvements and alienated by his veto of a bill rechartering the bank; the Calhoun-Hayne-McDuffie ultra-southern group; and the ANTI-MASONIC PARTY, which had supported Adams in 1828, and in 1831 held the first national nominating convention of any party, provided opposition. After a vehement campaign Jackson, "Democrat," received 219 electoral votes; Clay, "National Republican," 49; three minor candidates, 48. Jackson interpreted his overwhelming victory as an endorsement of his policies, and forthwith "met nullification at the threshold," although appeasing South Carolina somewhat by approving a tariff reform bill which mitigated the rates of the Tariff of 1832, and defied the Senate by re-

moving National funds from the United States Bank to private banks, although he had to change his Secretary of the Treasury twice to find a pliable agent.

The few matters of foreign concern until the last year of Jackson's Administration were ably handled. The negotiations of Louis McLane, American minister at London, resulted in the proclamation in 1830 of unrestricted trade with the British West Indies for the first time. William C. Rives, minister at Paris, concluded a treaty with the Government of Louis Philippe for the payment of damages to American commerce under the Napoleonic regime, and reduction of the duties on French wines. A commercial treaty with Mexico in 1831 was followed within five years by similar treaties with four South American countries; among other commercial treaties were two negotiated by Edmund Roberts with Siam and Muscat, our first Asiatic treaties. Nearly all these agreements were on a "most favored nation" basis, and included reciprocity as to employment of vessels and in some instances as to customs duties. This emphasis upon commercial benefits fitted into a period of industrial growth and rapid acceleration of transportation facilities. The first locomotive engine in America appeared in 1829; in the next year a steam-driven train of cars was running on the Baltimore and Ohio railroad. But the great projects of the time were concerned with canals, of greatest benefit in the middle states and Ohio. While the first caravans of settlers were moving along the OREGON TRAIL, the Mississippi valley was enjoying a boom of population and of land values. The BLACK HAWK WAR resulted in the opening of the upper Mississippi to legal entry by the insatiable pioneers; old trading posts became towns of importance, comparatively young settlements in the Ohio valley and Illinois became "parents" of new settlements in the prairie regions, and the districts of the Mississippi valley were fast moving through due Governmental processes to statehood. By 1835 the National debt was completely extinguished; tariff revenues were ample, nor was there any compelling sentiment for a reduction of duties, because of the apparent benefits of the protective system. Proceeds from the sales of public land annually mounted until in 1836, for the single time in our history, the sum, \$24,877,179, exceeded the revenue from customs. Clay's measure providing for the distribution of the greater part of the Treasury surplus among the states, proportionately to their representation in Congress, was enacted in June 1836. A month later, at Jackson's instance, the Treasury Department issued a Specie Circular, forbidding the land agents and the deposit banks to receive anything but gold and silver in payment for sales of public land; the fictitious prosperity of the nation thus was shattered, when the vast and diverse mass of state bank notes were deprived of their validity as National currency. Speculation and overcapitalization were checked; but the consequences of the reaction swept upon the man whom Jackson's influence placed in the Presidential chair in 1837, Martin Van Buren.

UNITED STATES OF AMERICA



1-5, LEET BROS. PHOTOS: 6-10, PACH BROS. PHOTOS

PRESIDENTS OF THE UNITED STATES, 1845-1881

1. James Knox Polk, 1845-49. 2. Zachary Taylor, 1849-July 9, 1850. 3. Millard Fillmore, July 9, 1850-53. 4. Franklin Pierce, 1853-57. 5. James Buchanan, 1857-61. 6. Abraham Lincoln, 1861-65; March 4, 1865-April 15, 1865. 7. Andrew Johnson, April 15, 1865-69. 8. Ulysses S. Grant, 1869-73; 1873-77. 9. Rutherford B. Hayes, 1877-81. 10. James A. Garfield, 1881-July 2, 1881.

Rise and Fall of "Whiggery." The disparate elements whose common bond was opposition to Jackson became known in 1834 as the WHIG PARTY. Not sufficiently amalgamated by 1836 to hold a national convention or publish a platform, their strategy was to put forward "favorite sons" as anti-Jackson candidates in the hope of preventing Van Buren from gaining a majority in the Electoral College and so throwing the election into the House. They underestimated the popular influence of the retiring patriarch, however; Jackson's candidate received 170 of the 294 electoral votes. Van Buren inherited from Jackson the SPOILS SYSTEM, which he protracted; the problem of annexation of Texas, which he postponed; the slavery question, endlessly debated in Congress and in the light of which every item of proposed legislation was ruthlessly scrutinized; and the Panic of 1837, the most abysmal depression into which the nation had fallen. To the deleterious effect of the Specie Circular were added a sudden, precipitous drop in exports, ravages of the Hessian fly in the wheat fields, and other misfortunes. Van Buren labored for two years with a quibbling Congress, at last in June 1840, securing the enactment of an Independent Treasury bill divorcing the public finances completely from any banking system. That the Administration was primarily responsible for the financial and industrial depression was the rallying point of the Whigs, who advanced in 1840 a ticket of national appeal which implied no political dogma whatever except "Down with Van Buren." WILLIAM HENRY HARRISON, military hero and "friend of the common man," but otherwise unidentified with political principles, and the Vice-Presidential nominee, JOHN TYLER, a states rights man named to gain southern votes, were overwhelmingly elected after a raucous, festive campaign of which "TIPECANOE AND TYLER TOO," similar slogans and homely ballads, replicas of Harrison's mythical log-cabin residence, and gratuitous dispensing of cider were characteristic. With the same rampant enthusiasm in which Jackson had been elected over Adams, the democracy had now spurned Jackson in the person of his lieutenant.

Harrison had died, and the Vice-President, for the first time in the history of the nation, had assumed the highest office, when in 1841 Clay introduced into the Senate a series of resolutions embodying the whole policy of the Whig Party leaders: the reestablishment of a United States Bank; the upward revision of the tariff; the distribution among the states of the proceeds of the sale of the public lands within their borders, as a measure for promoting internal improvements. Tyler refused to accept the program, and, listening to the flattery of Virginia friends who persuaded him that he was a national leader, separated himself from the party which had elected him. Webster, Secretary of State, alone of Harrison's appointees remained in the Cabinet after Tyler had made evident that he would approve no Bank bill. When his important negotiations with England culminated in the settlement of the CAROLINE INCIDENT and in the WEB-

STER-ASHBURTON TREATY, he resigned. The only positive impressions of Tyler's influence upon Congress were in his securing from the despairing Whigs a tariff bill sufficiently moderate to avoid his veto, and in the annexation of Texas after the election of 1844 had made annexation a foregone conclusion. Van Buren had failed to secure the Democratic nomination because the southern element feared he would prevent the acquisition of the slavery-inviting lands of Texas; JAMES K. POLK of Tennessee, a "manifest destiny" man, was the nominee. Clay, the Whig candidate, lost popular support by juggling the annexation issue obviously for political expediency. The anti-slavery LIBERTY PARTY, participating in its second national election, cut into Clay's strength in New York State; and with the loss of New York, Clay lost the election by 105 electoral votes to Polk's 170.

The political path for the advance of the American flag to the Pacific was cleared. The impetuosity of the United States forced Great Britain to conclude the Oregon question (*see* "FIFTY-FOUR FORTY OR FIGHT"; OREGON BOUNDARY TREATY); and after the failure of SIDELL'S MISSION events moved rapidly toward the MEXICAN WAR. American filibusterers, meanwhile, were active in Latin America, and the acquisition of Cuba as a further outlet for the expansion of slavery seemed most likely. But the great area acquired from Mexico in the TREATY OF GUADALUPE-HIDALGO (later increased somewhat, to facilitate the construction of a railway to the Pacific, by the GADSDEN PURCHASE) was not to be made accessible to slavery without a bitter political struggle. In 1848, however, the lines of the new struggle were not yet clearly defined; the election was of little significance. The two leading parties were looking for votes, irrespective of whence they came. LEWIS CASS, reputed a DOUGH FACE, the Democratic nominee, was opposed by Gen. ZACHARY TAYLOR, paradoxically the candidate of the party which had roundly condemned the war. Polk's tariff measure of 1846 had identified the Democratic Party with "tariff for revenue only"; Taylor, queried about the tariff and the Bank, replied that he had had "no time to investigate the issues," and was advanced by the Whigs, as Harrison had been, without the encumbrance of a platform. An outgrowth of a Democratic factional dispute in New York (*see* HUNKERS) was the nomination of Van Buren by the new FREE SOIL PARTY. The defection of normally Democratic votes in that state presented the National election to the military hero, by 163 electoral votes to Cass's 127. After one more National election, however, the Whig Party disappeared from view. No amount of sophistry could gloss over the slavery issue; the doom of the Whig Party lay in its failure to assume a hard-and-fast position on that vital question, and in 1852 the pretense of the party that the Omnibus Bill (*see* COMPROMISE OF 1850) enactments finally settled the status of slavery won for its candidate, WINFIELD SCOTT, only 42 electoral votes.

The Triumph of the Middle Class. Political democracy became a completed fact in the Jacksonian

era. The suffrage was widened by the removal of religious and property qualifications for office-holding and for voting, a process completed when in 1842, as an aftermath of DORR'S REBELLION, property qualifications were abolished in Rhode Island. The election of many officials hitherto chosen by the legislatures or special councils was placed in the hands of the people. Equalitarian tendencies, working eastward from the new states of the West which uniformly set up liberal constitutions, were welcomed by the increasing numbers of the middle class in the eastern states. Wealth was more evenly distributed than after the CIVIL WAR, when the development of large scale business was a characteristic of the new industrial order. In the earlier decades factories were small, partnerships were more common than incorporations, "shops" rather than "stores" were typical of retail business, and Jordan and Marsh's in Boston and A. T. Stewart's establishment in New York were conspicuous exceptions. The prevalence of opportunity to make a competence was reflected in the quality and quantity of immigration, not, as in the 1880's and afterwards, of Latin stock but of Teutonic and British. The United States conceived itself a haven for the oppressed and submerged elements of the Old World, and from 1820-60 received 1,880,943 Irish immigrants leaving a home country misgoverned and periodically famine-stricken; 1,545,508 Germans, many of them political exiles; in all, 5,055,938 aliens. The immigrants avoided the slavery states, and contributed greatly to the strength of the North in the forthcoming sectional conflict.

In 1837 HORACE MANN was appointed secretary of the newly created State Board of Education in Massachusetts, and an era was begun of extension and improvement of the public schools system throughout the North and Middle West. The new middle class was avid for self-improvement: 174 colleges and universities were founded in the four decades just preceding the Civil War; lyceums and cultural societies multiplied; temperance lecturers met with great success, and even feminists found curious and sometimes well-mannered audiences; spiritualists, phrenologists, "animal magnetists," and other unveilers of esoteric knowledge were received with ready interest. Cheaply bound novels, tales of adventure, of unrequited love, or other themes in the romantic tradition, were widely sold; periodicals annually increased, and, if they were "ladies' magazines," perhaps flourished. The "gold rush" to California in 1849-50 was, indeed, a more wildly romantic narrative than any of Cooper's or Simms's novels. That utopian socialism should gain a foothold in an optimistic generation which never doubted the abstract verities was natural. (See FOURIERIST PHALANXES; NASHOBA COMMUNITY; HARMONY SOCIETY.) The generation which viewed the *Greek Slave* by Hiram Powers as great but daring art, launched PHINEAS T. BARNUM into undying fame, and was thoroughly frightened by the mathematical proofs of William Miller that the world was about to come to an end, was also the generation which

abolished imprisonment for petty debts and reformed oppressions and inhumanities in many fields.

The Slavery Controversy. Two pacific phases of anti-slavery endeavor, the movement headed by Benjamin Lundy for emancipation by persuasion of the masters, and the attempt of the American Colonization Society to promote emancipation by sending the freedmen to Africa (in behalf of which the Government established the colony of Liberia in 1822) were acknowledged failures by 1831. In that year a notable debate in the Virginia legislature revealed that the new generation of southern plantation owners had repudiated the humanitarian philosophy of Jefferson's generation of slaveholders, and complacently asserted the permanence of the "peculiar institution"; WILLIAM LLOYD GARRISON began the publication in Boston of the militant *Liberator*; a bloody insurrection of slaves in Southampton Co., Virginia, frightened the entire South; and in December the House Committee on the District of Columbia reported, in answer to 15 petitions presented by John Quincy Adams, that Congress should not interfere with slavery in the District so long as slavery was legal in Maryland and Virginia. Four years later Oberlin, Ohio, became an important center of abolitionist sentiment; the UNDERGROUND RAILROAD was attracting attention, infuriating Southerners and bringing to the attention of the North instances of the harshness of slavery. In Congress James H. Hammond, Representative from South Carolina, and a fortnight later Calhoun in the Senate, moved that anti-slavery petitions be not received, in effect denying the Constitutional right of petition. An indignant mob of citizens of Charleston, S.C., made a bonfire of abolitionist literature seized from the post office. In May 1836 the House enacted a "gag law" automatically tabling all anti-slavery petitions; Adams denounced the unconstitutionality of the measure, and when Southerners became convinced that it defeated its own purpose, it was repealed in 1844. During Jackson's Administration the murder of ELIJAH LOVEJOY, abolitionist editor, in Alton, Ill.; the increase in lynching; in several northern cities, the sacking of the Negro quarters by rapsallion mobs, bespoke the violence of emotional differences.

The issue became irretrievably involved with the politics of the westward movement. Concerning Texas, Oregon, the National public lands policy, the authorization of a transcontinental railway, the Mexican War, and problems of territorial organization, popular opinion divided according to whether slavery was protected and furthered, or restrained or prohibited. The question took a new form in 1846, when the WILMOT PROVISIO implied that no more slavery states were to be admitted to the Union. Taylor, elected President in 1848, favored the doctrine later nicknamed SQUATTER SOVEREIGNTY as a solution; Congress, after bitter wrangling, in 1850 attempted a grand compromise, the Omnibus Bill, adding to questions arising from the Mexican cession settlement of the status of slavery in the District of Columbia and

a new stringent FUGITIVE SLAVE LAW. That popular opinion, South and North, was not to be satisfied by a compromise was suggested by threats of secession uttered at a convention at Nashville, June 1850, by delegates of two of the nine southern states represented, and by the avalanche of disapproval under which his own constituency buried Daniel Webster after his "Seventh of March" speech. Yet the imposing majority of FRANKLIN PIERCE, Democrat, in the Presidential election of 1852 seemed to indicate that "abolitionism" was on the wane. Southern expansionists were pleasurably excited by the OSTEND MANIFESTO (see also BLACK WARRIOR CASE), and the Know-Nothing Movement seemed the most interesting domestic issue, when the KANSAS-NEBRASKA BILL signalized the reopening of the old controversy. The REPUBLICAN PARTY was established in 1854 upon the principles of opposition to the expansion of slavery. Bona fide settlers hurried into Kansas by New England Emigrant Aid societies to contend for the destiny of that future state were harried and outvoted by KANSAS BORDER RUFFIANS, while a steady stream of emigration from Iowa, Illinois and Ohio made certain that the district would ultimately reject all Administration approved devices to maintain slavery in Kansas. Violence in the Senate matched the sacking of Lawrence, Kans., by a proslavery mob and John Brown's retaliatory massacre of proslavery men at Pottawatomie Creek. (See JOHN BROWN'S RAID.) The Republican Party expanded from its middle-western roots into the East, to be checked momentarily by the nativist political organization. In 1856 the Democratic candidate for President, JAMES BUCHANAN, nominated because as minister to England for the past three years he had escaped scorching in the heat of the Kansas-Nebraska debate, was elected by 174 electoral votes against 114 for John C. Fremont, Republican, and 8 for MILLARD FILLMORE (uneventfully the Whig President, 1850-53, after Taylor's death), who had accepted the Know-Nothing nomination. The DRED SCOTT DECISION was grimly rejected by the Republicans; the LINCOLN-DOUGLAS DEBATES pointed out to the Republican Party its proper candidate for 1860, while the party won an actual plurality in the House in the Congressional elections of 1858; John Brown's Raid repelled moderating sentiment in the South, while Buchanan and his Attorney-General, JEREMIAH S. BLACK, discussed the ethics of the situation and probed the constitutionality of possible remedies. With high emotional fervor overriding practical politics, the election of 1860 naturally revealed party disruption and a multiplicity of candidates. Southern opposition to Douglas's FREEPORT DOCTRINE was such that when the Northern Democrats secured the adoption of their platform by the National party convention, the delegates of eight states left the hall. The Southern Democrats placed a ticket of their own in the field. ABRAHAM LINCOLN, Republican, despite a popular vote of 930,170 less than his combined opponents, won an electoral majority. The CONSTITUTIONAL

UNION PARTY by its dismal showing demonstrated what the CRITTENDEN COMPROMISE soon proved in Congress: opportunity for peaceful compromise was past. The outcome of the election was alone sufficient to induce South Carolina, by unanimous vote in convention, to pass an ORDINANCE OF SECESSION. Forty-four days later the CONFEDERATE STATES OF AMERICA was formally launched; and in Apr. 1861 with the ostensible issue of the constitutional right of voluntary secession obscuring the fact that the irreconcilable conflict of diverse economic systems had at last resorted to force, the CIVIL WAR was begun.

THE NEW NATION, 1861-98

The Aftermath of the War. Gen. Sherman's (see SHERMAN, WILLIAM T.) occupation of Atlanta and the addition to the electorate of many thousand German-Americans who completed the naturalization process between 1860 and 1864 were potent factors in the reelection of Lincoln over the strong Democratic candidate, Gen. GEORGE MCCLELLAN, the gist of whose platform was that the North was tired of war. Harassed by agitation and conspiracy on the part of the COPPERHEADS, by editorial criticism of his suspension of *habeas corpus* and other assumptions of extraordinary powers for the prosecution of the war, by the strain of dreary months without military victories, Lincoln was spared what might have been his most exacting struggle, with the Radicals in Congress whose intent was to secure the political and economic subordination of the South, by the fatal bullet sped by JOHN WILKES BOOTH on Apr. 14, 1865, five days after ROBERT LEE had surrendered to Grant. ANDREW JOHNSON, the choleric Tennessean who completed Lincoln's term, pursued a policy of political reconstruction of the southern states which left those states largely free to designate the measure of civil rights which the freedmen should enjoy. The states abused this confidence to legislate the Negro into an inferior status; when Johnson in 1866 vetoed an act of Congress which provided that when a state by its laws discriminated against Negroes the President should extend military law over the state, the President was repudiated by Congress and the country, and control of southern reconstruction passed into the hands of THADDEUS STEVENS, CHARLES SUMNER, WENDELL PHILLIPS, and their followers in Congress. (See RECONSTRUCTION ERA; FREEDMEN'S BUREAU; CIVIL RIGHTS BILL; GRANDFATHER CLAUSES; CIVIL RIGHTS CASES; SLAUGHTERHOUSE CASES.) A TENURE OF OFFICE ACT designed to entrap Johnson into an offense adequate for impeachment gave rise to the trial of the President before the Senate; but the facts of the case and the ability of his lawyers favored Johnson, and the indictment failed. Successful in identifying the Republican Party with protectionism in tariff, and thereby ensuring the financial support of manufacturers, and in minimizing agrarian influence in national politics, the Radicals' program also bred sectional antagonism which dictated party allegiance for three generations after the war (see SOLID SOUTH),

and failed to establish social equality of the Negro because of adverse decisions of the Supreme Court.

During the war international relations were handled tactfully, e.g., the TRENT AFFAIR, by Secretary of State WILLIAM SEWARD and the chairman of the Senate committee on foreign affairs, Sumner. With the return of peace issues with Great Britain, some arising from favoritism shown by the English Government to the Confederacy and some, concerning boundaries and fisheries, of long standing, pressed for a settlement. To these problems was added the FENIAN RAIDS INTO CANADA. Yet by amicable negotiation all issues were settled, or commissions provided for their adjudication. See ALABAMA CLAIMS; SAN JUAN BOUNDARY CONTROVERSY; WASHINGTON, TREATY OF.

The healthy condition of industry and the millions of acres of free or cheap land, made more accessible by the HOMESTEAD LAW of 1862, permitted the North to absorb nearly a million soldiers into civil life with slight disturbance. Reconstruction of the public finances, perpetuation or retirement of the fiat money issued during the war, became a long-lived political issue. The adulation of a military hero, the elevation of Gen. Grant to the Presidency because his soldiers had won battles, was an obvious result of war; but the reaction away from ethical standards, the slackening of the moral fiber, was a far more extensive result than the post-war generation, preserving the externals of religious observance and unctuously pleased with the material expansion of the nation, itself realized.

The Democratic Convention of 1868 reflected the brief financial depression of 1867. Inflationists dictated the platform, calling for the payment in currency of Treasury bonds not specifically payable in specie, and for taxation of National bonds. But the rule of two-thirds majority for the nomination of a candidate, adopted in 1840 to prevent Van Buren's renomination, balked the inflationists, and the conservative HORATIO SEYMOUR was named. Grant, shrewdly nominated by the Republicans, won by 214 electoral votes to 80, and in 1872 was overwhelmingly reelected by 272 votes as against 66 for HORACE GREELEY. During the intervening four years Grant revealed a predilection for personal friendship over executive responsibility. Seward had in 1867 effected the Alaska Purchase; Grant was interested in another acquisition, Santo Domingo, which would permit the immediate investment of American capital with high returns, but Senator Sumner prevented the annexation. Grant narrowly escaped complicity in the notorious Wall Street scandal, BLACK FRIDAY. His opposition to civil service reform, and especially his concurrence in the Radicals' reconstruction program, were leading factors in the formation of the ill-fated party of opposition in 1872, the LIBERAL REPUBLICAN PARTY. During his second term glaring instances of official malfeasance, including the CREDIT MOBILIER OF AMERICA and WHISKY RING (see also STAR ROUTE FRAUDS), became public knowledge. Shortly before the Congressional elections of 1874 the Secretary of the Treasury resigned to escape a vote of censure be-

cause of the unsavory "sale" of a contract to collect overdue internal revenue, and this incident, with the "Salary Grab" act of Mar. 3, 1873, whereby Congress voted a retroactive increase in its pay, was reflected in the return of 168 Democrats, 108 Republicans and 14 independent candidates, to the House. The previous House had numbered 195 Republicans, 88 Democrats and 4 Independents. Astute Republican leaders accordingly forced the nomination of a man of unquestionable integrity, RUTHERFORD B. HAYES, for President in 1876. The Democratic candidate, SAMUEL J. TILDEN, prominent through his prosecution of the Tweed Ring in 1871, apparently had won the election when belated returns from South Carolina, Florida, Louisiana and Oregon revealed evidences of fraud which left the actual result undiscoverable. Congress created an extraconstitutional Electoral Commission which awarded the Presidency to Hayes by a strictly partisan vote.

Currency Questions; the Agrarian Protest.

The net receipts of the National Government during the four years of war, 1861-65, were \$667,123,247 in taxes, of which \$305,360,451 were from customs, \$356,846,136 from internal revenue and income taxes, and the remainder from a direct tax, and \$2,621,916,786 in loans, including Treasury notes. Large issues of short-term notes which circulated almost as money were supplemented by non-interest bearing legal tender notes, "greenbacks," of which \$433,000,000 were outstanding in 1865. Johnson's Secretary of the Treasury, HUGH McCULLOCH, a conservative financier, successfully refunded and reduced the debt; but gradual retirement of the greenbacks as a measure toward the resumption of specie payment (suspended in 1862, a time of financial crisis), as authorized by Congress in 1866, evoked a storm of protests from a people generally unwilling to have the volume of money lessened. In the West, where the Panic of 1867 was severely felt, opposition to any financial policy which benefited eastern capitalists was especially strong; in 1868, when \$356,000,000 in greenbacks was still outstanding, Congress ordered the contraction to cease. In 1873, however, following years of intense and prosperous business activity marked by a doubling of manufacturing capital; an influx of immigration, mostly unskilled labor (112,702 immigrants arrived in 1861; in 1873, about 460,000); an increase in grain production twice as rapid as the growth of population; and extensive railroad construction, including the first transcontinental line, there began the most acute depression since 1837. Capitalists perceived that the too rapid progress which was a major cause of the panic was in part due to the inflated condition of the currency; and the SPECIE RESUMPTION ACT was passed in 1875, a long stride toward sound finance. But in the West the average farmer was in debt for the price of his land or of improvements. Since the world's wheat supply exceeded the demand, succeeding crops failed to lift the indebtedness, and the frontier accordingly demanded financial panaceas of the Government. Intensified dependence upon railroad

transportation for the marketing of its products was another general characteristic of the frontier; in times of financial stringency Westerners naturally attempted to place restraints upon the railroad for the benefit of the shipper. Farmers' social organizations, the Grange and the Farmers' Alliance, assumed a decided political tinge, grew rapidly in the 1870's, and in the middle-western states secured sufficient legislative strength to establish railroad and warehouse commissions with revolutionary rate fixing powers. The Supreme Court (*see* GRANGER CASES) upheld the granger laws as fair in principle, driving into the hitherto prevailing theory of the immunity of private business from Government supervision a wedge that was to permit extensive regulation, e.g., the INTERSTATE COMMERCE ACT AND COMMISSION and the SHERMAN ANTI-TRUST ACT, of large businesses, and close restraints upon the conduct of public-utility corporations. The GREENBACK PARTY, voicing in national politics the demands of inflations and the agrarian protest, was succeeded by the POPULIST PARTY, whose major tenets were in turn absorbed by the DEMOCRATIC PARTY in 1896.

A Quarter-Century of Politics. Hayes throughout his Administration had to bear the charge of holding a stolen office; yet he was supported by a notable group of independents, CARL SCHURZ, GEORGE WILLIAM CURTIS, WILLIAM CULLEN BRYANT and others, who wielded great editorial influence in behalf of civil service reform and purity in politics. Against the opposition of the Stalwarts he removed the last remnants of military control in the South. An inflationist movement, to repudiate the CRIME OF 1873 by the free and unlimited coinage of silver, was partially successful (*see* BLAND-ALLISON ACT); but with the remarkable recovery of the wheat market in 1878 and the great industrial prosperity of 1879 inflation lost its popularity, and the monetary issue was of little consequence in the election of 1880. The Republican Party weathered a severe fight between its watchdogs of morality, of whom JOHN SHERMAN and WHITELOW REID were representative, and the machine politicians who wished to nominate the easy-going Grant for a third term; a "dark horse," JAMES A. GARFIELD, of spotty political record but of generally acknowledged upright intent, was nominated. For Vice-President CHESTER A. ARTHUR was named, a concession to the powerful head of the party machine in New York, ROSCOE CONKLING. Tilden, in popular opinion not cleared of complicity in an attempt to secure an electoral majority in 1876 by bribery, was not available for the Democratic nomination, and Gen. WINFIELD S. HANCOCK was named. Editorial ridicule of Hancock's reference to the tariff as "a local issue" and other instances of his unfamiliarity with politics contributed to the result: Garfield, 214 electoral votes, despite the small margin, 10,000, of his lead in the popular vote; Hancock, 155.

Garfield's assassination and Republican reverses in the Congressional elections of 1882 were factors in persuading the party to enact civil service reform. A

closely connected reform, the Australian ballot, was making headway in the states. In 1889 this ballot was used in Massachusetts, and was authorized in 35 states by 1892. Tariff reformers, theoretical free-traders and those who favored revision of the protective schedules conformably with revenue producing ability, were advancing their issue with increasing Congressional support; yet gigantic raids upon the Treasury in the form of "Rivers and Harbors" bills and suspicious liberality in the granting of pensions were complacent parts of legislative routine. In the Presidential campaign of 1884 all these issues were involved, but were overshadowed by charges of personal immorality hurled against the Democratic candidate, GROVER CLEVELAND, and official malfeasance against the Republican nominee, JAMES G. BLAINE, e.g., the MULLIGAN LETTERS. The opposition of the MUGWUMPS, of Conkling, of ROBERT G. INGERSOLL, the strength of the Prohibitionist candidate, the opposition of striking typesetters to any candidate supported by the New York *Tribune*, the colossal blunder of "RUM, ROMANISM, AND REBELLION," and stuffed ballot-boxes in the Coney Island district, combined to give Cleveland New York State by 1,149 votes, and with New York the Presidency. The partisan deadlock of Congress continued, and Cleveland's first Administration was marked by a paucity of legislation. Incurring the hostility of spoilsmen without satisfying extreme civil service reformers, and losing Congressional support by vetoes of private pension bills, Cleveland invited defeat in 1888 by forcing the party, divided against itself, to accept tariff for revenue only as its major campaign issue. In a campaign marked by the free solicitation of funds from manufacturers by Republicans and from office-holders by Democrats, BENJAMIN HARRISON, Republican, upon a platform demanding liberal appropriations for the navy and pensions and endorsing "the American system of protection," was returned by 233 electoral votes to Cleveland's 168; yet Cleveland had a popular plurality of 100,000, and would probably have been returned but for the opposition of TAMMANY HALL in New York State.

Breaking down partisan obstruction in the House by the high-handed methods of Speaker THOMAS B. REED, the Republicans voted the generous appropriations promised in the campaign, enacted the McKinley Tariff (*see* MCKINLEY TARIFF ACT), and passed the ambiguous SHERMAN SILVER PURCHASE ACT to placate western congressmen; but popular distrust of the Republican Party machine, in the hands of THOMAS C. PLATT and Matthew S. Quay, notorious spoilsmen, the decline in prosperity and the growth of labor troubles, and the obvious contrast between the personality of Harrison and of Cleveland, served to return Cleveland to the Presidency in 1892. When the new Democratic Administration began the gold reserve was at only \$100,982,410; the balance of trade with Europe was flowing against the United States; the wave of speculation which since 1878 had followed the creation of trusts, the rapid aggrandize-

ment of wealth by a new and conscienceless plutocracy, and the marketing of "watered" securities, came to an end. The financial panic of 1893 threatened even the Government. In order to maintain an adequate gold reserve the Administration forced the repeal of the Sherman Silver Act and arranged quietly for a loan from Wall St. financiers. Cleveland's enemies would not believe that he did not share the profits of the contract with the Morgan and Belmont syndicate; the free-silver and other inflationist elements repudiated him. In 1896 the inflationists controlled the Democratic Convention, defeated a vote to endorse Cleveland's Administration, dictated a platform including the rallying-cry "SIXTEEN TO ONE," and, casting about for a candidate certain not to compromise with the sound money, eastern element in the party, selected WILLIAM JENNINGS BRYAN. WILLIAM MCKINLEY, whose interests had been ably furthered by MARCUS A. HANNA, traction magnate and millionaire, was the Republican standard bearer upon a platform emphasizing protectionism in tariff and endorsing a gold standard. The currency issue promoted defections from both parties; a SILVER PARTY, GOLD DEMOCRATS, and Middle-of-the-Roaders were separate but unimportant identities in the vehement campaign which followed. Bryan received 176 electoral votes to McKinley's 271; but the "young Democracy," undaunted, and holding the leadership of the party against the deposed Easterners, renominated Bryan in 1900. Bryan attempted, not quite successfully, to make imperialism the major issue. McKinley was reelected by 292 electoral votes to Bryan's 155. The Democratic Party had repelled the support of business men by its economic radicalism; conservative interests and the Republican Party had become allies for mutual advantage. Throughout the period the PROHIBITION PARTY regularly entered a Presidential nomination, and once (see WOMAN'S RIGHTS PARTY) the organized feminists followed suit. Labor parties were numerous but of high mortality (see NATIONAL LABOR REFORM PARTY; SOCIALIST LABOR PARTY; UNION LABOR PARTY, and SOCIAL DEMOCRAT PARTY); but in 1900 a party destined to remain, the SOCIALIST PARTY, participated in its first campaign.

Foreign Relations. Until the laying of the Atlantic cable in 1866 our representatives in Europe, by virtue of the slowness and difficulties of communication, enjoyed a remarkable degree of freedom and of responsibility; but thereafter matters important and unimportant were referred to the Department of State, and the caliber of the foreign service declined with the diminished responsibility. Ministerial appointments were sought by men of wealth for social advancement, and in many instances were conferred in reward for party campaign funds. The securing of introductions for American debutantes and dowagers to the court at which he was accredited became a chief occupation of the diplomatic representative. The succession of ministers to Great Britain, however, was an exception to the general rule of mediocrity. Nor was there, between HAMILTON FISH, who resigned in

1877, and John Sherman, who gained the position in 1897, a Secretary of State of marked aptitude. Shifting party supremacy placed in the Secretariat a succession of men who had no regard for the continuity of policies. Secretaries appointed by Cleveland discarded what their predecessors had begun, and within the Republican administrations Blaine, appointed in 1881 and again in 1889, in each instance pursued aggressively anti-British and broadly pan-American policies at variance with the policies of other Republican Secretaries of State. Renewed difficulties over the Canadian fisheries question, the BERING SEA CONTROVERSY, Blaine's endeavors to force the cancellation of the Clayton-Bulwer Treaty, the VENEZUELA BOUNDARY DISPUTE during Cleveland's second term, and, at the close of the century, the beginning of negotiations to adjust the Alaskan Boundary Dispute (see ALASKAN BOUNDARY TRIBUNAL), were the most important matters of diplomatic intercourse with Great Britain. Blaine's hopes of making the United States an "elder sister" to the Latin-American republics, resting largely on the development of commercial relations stimulated by treaties of reciprocity, were dashed by Congressional indifference. But, while the growth of American influence in Latin America was left to private capitalists, our influence in the Pacific was extended by the annexation of Hawaii in 1898, after Cleveland had prevented prior annexation; the acquisition of Tutuila in 1899, and the occupation of a score of small islands in the last two decades of the century.

Capital and Labor. In the industrial boom after the Civil War railway construction and the combination of existing railways were favored projects. The produce of the Mississippi valley had increased faster than the means of transporting it to marketing centers, and the rapid strides of settlement into the farther West not only created new needs of communication but suggested that railways could stimulate the migration by anticipatory construction. The total mileage in 1872, about 70,000, was double that of 1865. The existing lines each year created more wealth than was absorbed by the cost of extensions. The first of the transcontinental railways, the Union Pacific, was completed in 1869; the Northern Pacific was chartered in 1864, and other grandiose projects were initiated, some, like the Union Pacific, subsidized by gifts from the public domain. In 1868 Commodore Vanderbilt (see VANDERBILT, CORNELIUS AND FAMILY) began the process of consolidation which culminated in the New York Central system, and other trunk lines joining Chicago and New York followed. In this period of speculation and over-expansion the manipulation by JAY COOKE of the Northern Pacific, often cited for its recklessness, was actually relatively conservative. Bull pools to drive stock to high levels, the payment of dividends out of bond issues, the maintenance of expensive lobbies in legislative anterooms, were common practices. Fierce competitive warfare led to pooling arrangements, secret rebates, and discriminatory rates which ultimately in-

vited Governmental supervision of railroads. Other industries than railroads developed amazingly. The Bessemer process gained a foothold in the middle 60's, and steel by its new cheapness created such a demand that by 1875 a dozen important Bessemer works were in operation. The American production of steel had risen to 929,000 tons in 1879, and the Michigan iron mines were being commensurately exploited. As the Great Plains became a cattlemen's frontier, and when refrigeration was invented, the American meat packing business developed into an international enterprise. As Minnesota became a vast grain raising area, the center of the milling industry shifted westward, and its capitalists found in the co-existence of wheat fields, water power and railroads about Minneapolis the means of expanding profits. The Pennsylvania petroleum fields produced the first crop of "oil millionaires." Textile and leather industries, almost every field of business, by consolidation and expansion produced new wealth.

This accumulative process was twice interrupted in 1873 and in 1893. Again, in 1907, business had completed another cycle, but emerged quickly from the slough of despond. In each instance factory workers, unskilled and exploited labor, the people with small savings-banks accounts, bore an unequal share of the burden. The Panic of 1873 was the first prolonged depression of the new industrial era; the 2,225,000 to 3,000,000 men who lost employment exhibited little of the docility which characterized similarly unfortunate men in the 20th century. Employers aggravated class feelings by ruthless cutting of wages; the threat of a lockout was usually sufficient to force acceptance. Workers resigned from trade unions in fear of the employers' blacklist, and joined secret labor societies. The most important of these was the KNIGHTS OF LABOR, but the lawless MOLLY MAGUIRES attracted the attention of the outside public. Workers' political parties appeared in several states, in time to fuse with the Greenback movement. A long list of strikes, each resulting in defeat and added misery, was the prelude to the first nation-wide conflict, the railway strike of 1877, a desperate, bloody struggle which collapsed within three months. Beginning in 1879 the Knights of Labor set aside one-third of its funds to assist in strikes. From 1884-87 the order was at its greatest strength; these years embraced another era of wage cuts, averaging about 15 per cent, according to Bradstreet, which added to the membership of the order and also caused a large number of strikes. In the subsequent years of readjustment the AMERICAN FEDERATION OF LABOR grew in membership, at the expense of more radical organizations; but simultaneously exotic radicalism gained adherents among laborers, and especially in the largest cities revolutionary and anarchistic groups became a dangerous factor (*see* HAYMARKET RIOT). When the full effects of the Panic of 1893 had penetrated to the lower levels of the economic system, another epidemic of strikes was the response; the greatest was the strike in the yards of the Pullman Palace Car Co., Chicago, de-

feated largely by a Federal injunction enforced by Federal troops. The country at large was uneasy; even COXEY'S ARMY, a predestined fiasco, created general alarm. In the next two decades, although the demands of labor were less concerned with wages, more with shorter hours and improved working conditions, this uneasiness was reflected in the attitude of the courts. (*See* DANBURY HATTERS CASE; BUCK STOVE AND RANGE CASE.) Labor was similarly overfearful of the effects of immigrant competition. *See* KEARNEYISM; CHINESE EXCLUSION ACTS; JAPANESE EXCLUSION ACTS.

IMPERIALISM AND LIBERALISM, 1898-1914

War with Spain. Cuba and Porto Rico, the last possessions of Spain in the western hemisphere, were victims of ruthless exploitation and corrupt administration. A revolutionary uprising in Cuba, 1868-78, was largely maintained by arms and supplies forwarded by insurgent juntas in New York and New Orleans; relations between the United States and Spain were put to serious strain by the VIRGINIUS AFFAIR, and urgings from Washington that the insurgents be given concessions received unsatisfactory answers from Madrid. Under Maximo Gomez in 1895 the liberals of Cuba again took up arms. Again American sympathy favored the revolutionists, filibustering expeditions brought adventurous Americans to fight beside the natives, and Cleveland with difficulty enforced official neutrality. The barbarity of the war in Cuba, particularly of the Spanish commander-in-chief Weyler's policy in herding noncombatants into garrisoned towns without adequate provision for food and housing, was emphasized by the Hearst papers and other sensational dailies; when McKinley became President public opinion was at high tension. The publication on Feb. 9, 1898, in a New York newspaper, of a private letter by Señor de Lome, Spanish minister in Washington, describing McKinley as a "cheap politician," was followed within a week by the explosion of the United States battleship *Maine* in Havana harbor. On Apr. 9, however, the governor general of Cuba was instructed to grant an armistice to the insurgents. McKinley, pious but of indecisive character, failed to grasp this opportunity to effect a peaceful solution, and, convinced that the fortunes of the Republican Party lay in satisfying the popular demand for war, submitted the issue to an avid Congress. The SPANISH-AMERICAN WAR found the United States unprepared in a military sense; Russell A. Alger, Secretary of War, was one of several politicians in high position whose nonfeasance permitted waste of money and lives. War funds were derived from a bond issue of \$200,000,000 in denominations sufficiently low to appeal to the common people, and by special internal revenue duties. Malaria, typhoid and yellow fever proved more dangerous to the American soldiers in the central sphere of action, the West Indies, than the Spaniards. Only four months of actual hostilities sufficed to conclude the war; and in the formal peace negotiations (*see*

PARIS, TREATY OF, 1898) the only serious issue not already settled by the complete humiliation of the Spanish army and navy was the disposition of the Philippines.

Imperial Responsibilities. An insurrection in the Philippine archipelago was unquieted at the outbreak of the Spanish-American War; the "Visayan Republic" was organized in Luzon after the Americans had captured Manila, and the islands might have been turned over to the natives, as was Cuba, had not Admiral GEORGE DEWEY reported that the "Republic" was a factional movement unable to maintain order over an extensive area. A majority of the press and public, actuated by religious zeal, commercial motives and nationalistic pride, seemed to favor acquisition; and the Philippines were purchased from Spain for \$20,000,000. Resentment of Filipino insurgents at the sale and the injudicious severity of the American army in Luzon in dealing with the natives brought about the PHILIPPINE INSURRECTION; military Government was superseded in 1901 by a civil commission headed by WILLIAM H. TAFT, governor general of the islands. Restoration of order in Cuba was based upon measures of sanitation and of cautious restriction of the franchise. The propertied and literate class permitted to vote established, by orderly procedure, a republican Government with a constitution which, desiring to leave Cuban sovereignty unimpaired, included no reference to future relations with the United States. The American Congress, however, refused to authorize the discontinuance of the military administration until the United States was assured of certain tangible and intangible supervisory powers; and the provisions of the PLATT AMENDMENT were reluctantly incorporated into the Cuban Constitution. The acquisition of dependencies had not been contemplated by the framers of the American Constitution; questions of the application of the American tariff laws to the Philippines and Porto Rico, and of the measure of participation in the rights of American citizens gained by the inhabitants of the dependencies, were debated in Congress. The authority of that body to determine how far the Constitution applies to dependencies was upheld by the Supreme Court in the INSULAR CASES. Congress was enabled, accordingly, to legislate as the special needs of each dependency suggested, and to correlate its regulations with the economic and political progress of the natives. The possession of insular dependencies expanded the interest and influence of the United States in foreign affairs; the new rôle of the United States was accentuated in 1899 by the creditable influence of this nation in the settlement of the BOXER REBELLION, its leading part in The Hague Conference, and the pronouncement by Secretary JOHN HAY of the OPEN DOOR policy in China. In THEODORE ROOSEVELT the United States had a president whom the rulers of Europe regarded as a colleague of equal prestige. Roosevelt on several occasions impressed his personality upon world politics, notably in the RUSSO-JAPANESE WAR; he added the construction

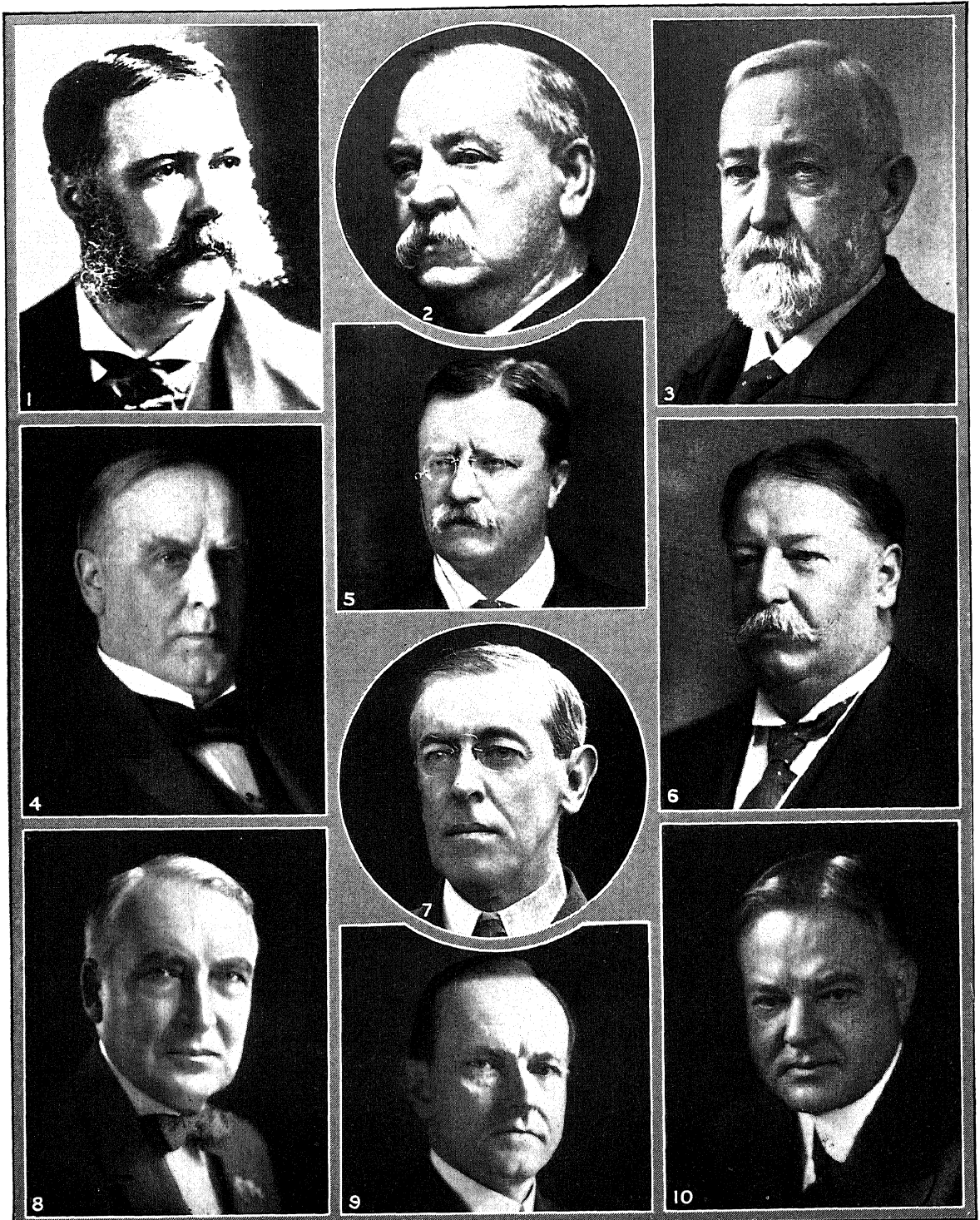
of the PANAMA CANAL to American expansionist activity, and restated the Monroe Doctrine in a way to make the United States virtually supreme in the western hemisphere.

"Muckraking" and the "New Freedom."

Roosevelt, becoming President in Sept. 1901, when McKinley died from the effects of an assassin's bullet, promised adherence to the policies of his lamented predecessor, and made no changes in the Cabinet; but five months later the news that the Government was instituting suit against the Northern Securities Co. (see NORTHERN SECURITIES CASE) created consternation in Wall Street. The high Dingley Tariff (see DINGLEY TARIFF ACT), the formal establishment of the gold standard in 1900, disinclination of the McKinley Administration to evoke the Anti-Trust Act, and other favors had permitted the industrialists and financiers to reap the richest rewards of the up-grade movement which followed the Panic of 1893. After 1897 consolidation of ownership had become a marked characteristic of the American economic system; by 1904 318 industrial trusts represented mergers of nearly 5,300 plants and a capitalization of over \$7,000,000,000. By 1903, however, the stock market was overloaded with "undigested securities," a fruit of industrial overexpansion, and a sudden tightening of the money market brought about the so-called "bankers' panic," which affected the masses but little. In 1904 the Supreme Court ordered the dissolution of the Northern Securities Co.; and thereafter the force which J. P. Morgan called "Rooseveltism," more often an intangible shadow than a specific injunction, acted as a curb upon the exploitative schemes of the moneyed magnates. With the publication in *McClure's Magazine* for Nov., 1902, of the first installment of Ida M. Tarbell's exposure of malpractices of the Standard Oil Co., the muckraking movement (christened by Roosevelt, in allusion to a character in *Pilgrim's Progress*) was well under way, meeting immediate popular response, and creating a demand for the restraining of large corporations and for the purification of politics. For almost 10 years, until the critical spirit of the Muckrakers was merged into the crusading spirit of the Progressive movement, most of the leading magazines contributed toward the accumulation of a great body of sociological investigation.

The result was a salutary "housecleaning" in many municipalities, some valuable additions to the Federal bureaucracy, and a modicum of corrective legislation. Under Roosevelt's leadership the law against rebating by railways was strengthened (see ELKINS ACT) in 1903, and after a bitter fight conditional rate-making power and other important prerogatives were given the Interstate Commerce Commission by the HEPBURN ACT of 1906; rigorous government inspection of meat products was established; adulteration and misleading labeling of food and drugs sold in interstate commerce was forbidden; contribution by corporations to the campaign funds of political parties was made illegal; the Department of Justice instituted suits

UNITED STATES OF AMERICA



1. UNDERWOOD AND UNDERWOOD PHOTO; 2-10. PACH BROS. PHOTOS

PRESIDENTS OF THE UNITED STATES, 1881-1933

1. Chester A. Arthur, 1881-85. 2. Grover Cleveland, 1885-89; 1893-97. 3. Benjamin Harrison, 1889-93. 4. William McKinley, 1897-1901. 5. Theodore Roosevelt, 1901-05; 1905-09. 6. William Howard Taft, 1909-13.
7. Woodrow Wilson, 1913-17; 1917-21. 8. Warren G. Harding, 1921-August 2, 1923.
9. Calvin Coolidge, August 3, 1923-25; 1925-29. 10. Herbert Hoover, 1929-33.

UNITED STATES OF AMERICA



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FRANKLIN DELANO ROOSEVELT

Elected thirty-second President of the United States

against monopolies, in some instances forcing bulky corporations to disgorge certain holdings. Popular support of the Rooseveltian program in domestic and foreign concerns was such that, despite the nomination by the Democrats of a "sound money" man, ALTON B. PARKER, Roosevelt in 1904 received a popular plurality of 2,544,343 votes and 336 electoral votes to Parker's 140. In 1908 Roosevelt's own selection, his Secretary of War, William H. Taft, easily received the Republican nomination and defeated Bryan, again the Democratic candidate, by 321 electoral votes to 162. Taft's platform promised revision of the tariff, one field of reform which Roosevelt had studiously avoided, in a special session of Congress immediately after the inauguration. The PAYNE-ALDRICH TARIFF, product of political machination, was the unacceptable result; Taft's speech at Winona, Minn., in praise of the new tariff, suggested that the retired President might feel he had been unwise in his choice of mantle bearer to prolong the Rooseveltian policies for four or eight years.

In Taft's philosophy Congress and the Federal judiciary apparently outranked the Presidency in the Constitutional trinity; as titular leader of the party, he was anxious to heal the factional breach which Roosevelt had cleft. Yet he aggressively carried on Roosevelt's policy of prosecuting monopolies, with even greater success (although by informal understandings, trade associations, interlocking directorates, and other means monopolistic practices continued and were extended, even in instances in which the Federal courts had broken up the offending trust), and urged upon Congress a Federal commission to authorize and supervise corporations engaged in interstate commerce. (See MANN-ELKINS ACT.) Conservation of National forest and mineral lands received greater attention from Taft than from any other President, except possibly his predecessor; but his support of Secretary of the Interior Ballinger when GIFFORD PINCHOT, head of the Forestry Bureau, accused his superior of turning National resources over to private exploitation weakened his record. His "pet" project, the TAFT-FIELDING RECIPROCITY AGREEMENT, was defeated by Canadian action. Postal savings banks were authorized; a commerce court was added to the Federal judicial system; a Constitutional amendment, the 17th, for the popular election of senators was passed by Congress, and submitted to the states. But several creditable enactments did not appease a public mistrustful of a conservative President and of a party which had produced CANNONISM and the Payne-Aldrich tariff. In 1910 a Democratic House had been returned; in 1912 came the holocaust. With the Democratic nominee, WOODROW WILSON, preaching a "new freedom" of the common people from government in the interests of the moneyed classes, and the indignant Roosevelt himself heading the defection of the liberal Republicans (see PROGRESSIVE PARTY) when the machine's control of the national convention was made manifest, Taft received in the November election 8 electoral votes (Vermont and Utah)

against 88 for Roosevelt and, although the winner failed to receive a majority of the popular vote, 435 for Wilson. The new Democratic Administration embarked upon the legislative course marked out in Roosevelt's tenure; the FEDERAL TRADE COMMISSION was created, and the Clayton Act was designed to close loopholes in the Sherman Anti-Trust Act. An income tax was a feature of the UNDERWOOD TARIFF ACT; Wilson forced an investigation of the "tariff lobby" which revealed sinister influences and led to the resignation of one member of the House. The establishment of the FEDERAL RESERVE SYSTEM was probably the crowning achievement of his first Administration; but the notable list of Congressional enactments included a Seaman's Act for the improvement of working conditions on ocean-going vessels and on lake and river craft; a Rural Credits law to enable farmers to borrow at low rates of interest from Federal Land Banks on farm mortgage security; a Federal Workingmen's Compensation Act applicable to civil service employees; the Newlands Act creating a permanent board of arbitration in railway labor controversies; and the ADAMSON LAW.

Latin-American Relations. The way for independent action cleared by the HAY-PAUNCEFOTE TREATY, Secretary of State John Hay negotiated a treaty with the Colombian *chargé d'affaires* granting the United States a canal zone across the isthmus of Panama. The Colombian Senate rejected the treaty as an unconstitutional alienation of territory, and because the payment offered was inadequate. In the State of Panama, dissatisfied with the rejection, a revolution shortly occurred, the progress of which was reported to Roosevelt from its inception, and the success of which was vitally dependent upon the presence of American men-of-war to prevent the landing of Colombian troops at the harbors of Colon and Panama. The HAY-BUNEAU VARILLA CONVENTION, speedily concluded with the infant republic, was defended by Roosevelt upon the grounds of our rights under the treaty of 1846, "our national interests and safety," and "the interests of collective civilization." Excavation began in 1906, and the gigantic labor was completed eight years later. Anticipating a parallel enterprise, the Bryan-Chamorro Treaty of 1914 with Nicaragua gave the United States exclusive rights to a canal zone in that country. Naval strategy as a basis of Latin-American policy has become of almost equal import with the Monroe Doctrine. Roosevelt in 1904 transformed the Doctrine into a mandate for American imperialism, expressing the obligation of the United States to exercise an "international police power" in the western hemisphere. In that year he proposed to the Senate the establishment of a fiscal protectorate over Santo Domingo, then bankrupt, as a "practical test of the efficiency of the United States in maintaining the Monroe Doctrine," and upon the refusal of the Senate established such a protectorate as a *modus vivendi*. Similar protectorates were established in Nicaragua, 1911, and Haiti, 1915, and maintained by the presence of American marines. As the

smaller Latin-American countries are debtor nations, they have generally acceded to, or invited, American fiscal supervision.

American capital, a weighty factor in all Caribbean countries, flowed into Mexico during the Diaz regime, 1877-1911. In the chaotic conditions succeeding the overthrow of the dictator American investments were endangered, and international relations became precarious when President Wilson refused to recognize the Presidency of Huerta. Following a dispute over a salute demanded by Admiral Mayo of the United States Navy, Vera Cruz was seized on Apr. 21, 1914, by a force of marines. War was checked by the offer of Argentina, Brazil and Chile, to mediate. Wilson accepted; but the dispute was in fact settled by the domestic overthrow of Huerta. Francisco Villa, former bandit chieftain, heading a faction which represented American influence in Mexico, on Mar. 9, 1916, conducted a raid upon Columbus, New Mexico, in which 18 Americans were killed. A punitive expedition of 12,000 troops under Gen. JOHN PERSHING was sent into Mexico in pursuit; forays of Mexican bands into Texas while the troops were still in Mexico induced President Wilson to call 150,000 militiamen to guard the international border. The expedition failed of its object, and almost simultaneously with the severance of diplomatic relations between the United States and Germany the troops recrossed the Rio Grande.

THE WORLD WAR AND AFTER

A Belligerent Europe. The American nation, attentive for a decade to questions of domestic reform, was amazed at the sudden outbreak of war (see WORLD WAR) in Europe, and was at first eager to maintain neutrality. On Aug. 4, 1914 Wilson proclaimed a state of neutrality, and later in the month appealed to his constituents to be "neutral in thought." An immediate effect of the World War in the United States was a prodigious increase in commerce, as the merchant tonnage of European nations was blockaded or diverted to military uses and as demand for American materials mounted with the derangement of European industry. Congress on Aug. 18, 1914, to encourage the purchase of merchant vessels built in neutral countries, made such vessels eligible for immediate registration, and, American shipping remaining unequal to the demands, provided on Sept. 7, 1916, for the acquisition, construction and operation of merchant vessels by the Government. Between these two dates many agencies of propaganda, pro-Central Powers and pro-Ally, had become active; but the policies of both Great Britain and Germany on the high seas were offensive to the United States. England arbitrarily and frequently seized cargoes of contraband in American ships destined for neutral countries adjacent to Germany, and in Mar. 1915 proclaimed a blockade including certain neutral ports which Wilson vainly protested as "illegal and indefensible." British policy further overreached international law in considering food, even though not

intended for Governmental military uses, as contraband. The offense of these interferences and restrictions was ameliorated by a liberal system of compensation. The statement of the British Government in 1916 that it would submit cases of disputed seizures to arbitration was the more acceptable to the United States because the German submarine policy, together with flagrant and blundering violations of neutrality by German agents, had produced a blaze of popular indignation. The submarine, too recent a development to have been treated by international law, was used ruthlessly by the nation which had perfected it. The British steamer *Fabala* had been torpedoed with the loss of one American life, Mar. 1, 1915, and one American steamer, the *Gulflight*, submarined, May 1, when on May 7 a crisis was precipitated by the sinking of the British liner *Lusitania*, known to be carrying military supplies. Among the drowned were 114 Americans. Wilson sent several spirited protests to the German Government, and ordered the preparation of comprehensive plans for expansion of the American army and navy. American policy was clarified by the resignation of Bryan, whose views did not embrace possible resort to war, and the succession of ROBERT LANSING as Secretary of State. German submarine policy was modified; the sinking of two passenger vessels which bore Americans, the British *Arabic*, Aug. 18, 1915, and the French *Sussex*, Mar. 24, 1916, were the only incidents in the next few months of vital concern to the United States, and Wilson's ultimatum after the sinking of the *Sussex* evoked a pledge that unrestricted submarine attacks should cease. That concession was observed for nine months.

The United States Enters the War. Wilson committed himself to "preparedness" in his annual message to Congress of Dec. 1915. Congress responded by placing, among other acts, the state militias under Federal control, and creating the Council of National Defense, embracing six Cabinet members, to direct the industrial mobilization of the nation in case of war. Yet "he kept us out of war" was logically the popular Democratic slogan in the campaign of 1916. CHARLES EVANS HUGHES resigned an associate justiceship of the Supreme Court to become Wilson's Republican opponent. The business men of the country, favoring war, supported him. By adding the Republican votes of 1912 with those of the now moribund Progressive Party, Hughes seemed assured of success. His over-cautiousness to avoid alienation of German-American support proved poor strategy, however, and cost him the election. Democratic strength in the woman suffrage states, notably California, assisted in returning Wilson by 277 electoral votes to 254. The Central Powers tragically misinterpreted the election, assuming that Wilson had been returned with a mandate to keep out of war at any cost, and planned, in one concentrated effort to change the fortunes of the war, to utilize unrestricted submarine warfare again. On Jan. 31, 1917, Germany announced an extensive blockade of the western

coast of Europe and in the Mediterranean, to be enforced by the sinking of all merchant ships, with conditional exceptions, without regard to the safety of persons on board. Three days later Wilson recalled Ambassador JAMES W. GERARD from Berlin and presented passports to Ambassador Johann Bernstorff. On February 25 two American lives were lost in the sinking of the liner *Laconia*; three days later the Zimmermann note was made public. Although lacking authorization from Congress, the President ordered guns to be placed on American merchant vessels. Three of these vessels were submarined on Mar. 18; Congress was summoned to meet in extra session, and passed a joint resolution declaring war on the German Empire on Apr. 6.

Under the President's active leadership Congress passed a succession of comprehensive measures for the mobilization of men, industries and money. The Selective Service Act of May 18, 1917 authorized the conscription of 1,000,000 men between the ages of 21 and 31 (on Aug. 31, 1918, the limits became "18 to 45"), an increase of the regular army to 287,000, and the mustering of the National Guard, the militia, into the Federal service. Thirty-two training cantonments were established. A War Industries Board was given extensive powers over the processes of manufacture to increase production of military supplies. The Food and Fuel Control Act of Aug. 10, 1917 gave HERBERT C. HOOVER, Food Administrator, extraordinary powers for the conservation of food and the stimulation of agriculture, and HARRY A. GARFIELD, Fuel Administrator, like control of coal and petroleum. Posters, "four-minute speakers," and moving pictures were potent measures in rallying an already enthusiastic public to the support of war measures. A Committee on Public Information, George Creel, chairman, distributed to newspapers and public invigorating literature. Dissent from or interference with the aims of the Government were made punishable by the Espionage Act of June 15, 1917, the Sedition Act of May 16, 1918 and the Deportation Act of the following October; and by similarly drastic state legislation. Suspects were frequently dealt with by extra-legal vigilance committees.

The War and the Settlement. The European Fleet, under Admiral WILLIAM S. SIMS, saw the most active service of the five divisions of the United States Navy. Cooperating with British vessels, it patrolled the lanes of traffic to protect shipping against submarines, convoyed transport ships, and assisted in the laying of a great mine barrage to hinder German submarines from reaching the high seas. Gen. J. Pershing was early sent to France to serve as commander of the American Expeditionary Force; in Jan. 1918, the several American divisions which had already arrived and had been brigaded with British or French troops were assembled, and the American Army thereafter operated as a unit. American troops were prominent in the operations along the Marne salient, the St. Mihiel salient, and in the Meuse-Argonne offensive. While American participation was chiefly

confined to the western front, a regiment was dispatched to the Austro-Italian front in July 1918, and some 15,000 Americans were members of Allied expeditionary forces which combated Bolshevism in northern Russia and eastern Siberia. The American Army abroad and in this country numbered over 3,500,000 on Nov. 11, 1918, of whom about 1,390,000, two-thirds of those who had reached France, had seen active service. The United States on that date was responsible for 22 per cent, about 100 miles, of the western front. American deaths from all causes totaled 125,000; despite the epidemic of influenza pneumonia which took heavy toll in the army cantonments in the fall and winter of 1918, the death-rate from disease was for the first time in the history of wars of the United States less than half the total fatalities. American aviators, flying planes built wholly or in part in Europe because of the failure of American factories to produce combat planes in time for service, brought down 755 enemy planes, and themselves lost less than half that number.

President Wilson, renewing his efforts begun before American participation to conclude the war on an idealistic basis, presented a succinct statement of an acceptable peace settlement to Congress in Jan. 1918. In October German overtures for peace based upon these FOURTEEN POINTS were accepted under conditions imposed by the Allies. Wilson had hoped to serve in the peace negotiations at Paris as the exponent of a moral crusade to eradicate the possibility of future wars, supported by the public opinion of his nation; but growing dissatisfaction with his imperious leadership was expressed in the Congressional elections of 1918, which resulted in Republican majorities in both houses. Wilson headed a commission of five (including Lansing, Henry White, EDWARD M. HOUSE, and Gen. TASKER H. BLISS) who represented the United States in the negotiations. In practice the President dominated his commission; but the final document (*see* VERSAILLES, TREATY OF) manifested the influence of Wilson's Fourteen Points only in diluted form. On July 10, 1919 the President presented the treaty to the Senate in Washington, and as the debate was protracted attempted an extensive speaking tour to rouse public opinion to demand ratification of the document. He returned to Washington an invalid, but intractable in demanding ratification without reservations. The vote on Mar. 19, 1920 fell short of the requisite two-thirds (57 to 39); the fear was that membership in the LEAGUE OF NATIONS, implicit in the ratification of the treaty, would involve the United States in foreign wars. The Knox Resolution repealing the declarations of war, in effect a separate peace with the enemy powers, was vetoed by Wilson; but under his Republican successor separate treaties of peace with Germany (BERLIN, TREATY OF), Austria and Hungary were concluded in 1921.

The ideal of prevention of future wars survived the rejection of the Versailles Treaty; toward that ideal the Harding Administration (*see* HARDING, WARREN G.) contributed the WASHINGTON CONFER-

ENCE, the Coolidge Administration (*see* COOLIDGE, CALVIN) the Kellogg Pact, and each of the three Republican presidents succeeding Wilson urged, although without success, that the Senate give unqualified authorization to the entrance of the United States into the WORLD COURT. The United States assumed a closer bond with European affairs when, on June 20, 1931, President Hoover proposed a moratorium for a year on intergovernmental debts and reparations; accord was soon reached with all important creditor nations. The visits of Premier Pierre Laval of France, Oct. 1931, and of Foreign Minister Dino Grandi of Italy, Nov. 1931, to President Hoover in Washington, for direct consultation on mutual problems, were further demonstrations of the importance of the United States in the post-war world.

Political Currents. Having in the previous month interdicted the manufacture of spirituous liquors as a measure of war-time conservation, Congress on Dec. 18, 1917 adopted the 18th Amendment, forbidding the manufacture, transportation and sale of intoxicating beverages. The culmination of many decades of abstinence agitation was largely due to the masterful lobbyist then heading the Anti-Saloon League, Wayne B. Wheeler. Prohibition, as defined by the drastic Volstead Act, became law on Jan. 16, 1920; its desirability, only a regional issue in the elections of the next two years, became a national question of increasing moment, a question particularly embarrassing to the Democratic Party, whose southern constituency favored prohibition while its northern constituency opposed it. In 1926 and in each election year thereafter anti-prohibition candidates for office made notable gains, and an extensive poll taken by the *Literary Digest*, an editorial periodical, in 1930 strongly suggested that a majority of citizens favored repeal or modification.

A second constitutional amendment of great social significance, the 19th, became law on Aug. 18, 1920; arguments for the political inferiority of women became obsolescent when women efficiently replaced men in many vital trades and professions during the war, and the amendment, passed by Congress on June 5, 1919, was quickly ratified by the requisite number of states. The volume of the addition to the electorate was suggested by the outcome of the Presidential election of 1920, when the Republican Warren G. Harding, a "dark horse" candidate, was elected by an unprecedented majority of over 7,000,000 votes.

Corruption during Harding's Administration, which came to light after his sudden death on Aug. 2, 1923, obscured his comparatively creditable Administrative record. The TEAPOT DOME SCANDAL was perhaps the most glaring of several scandals. The Alien Property Custodian and the Director of the Veterans' Bureau were convicted of malfeasance; three members of the Cabinet, ALBERT FALL, EDWIN DENBY and HARRY M. DAUGHERTY, resigned under pressure. Mr. Claude G. Bowers, eminent Democratic publicist, wrote a volume, *The Tragic Era*, rehashing the story of corruption under President Grant, impressing upon

thousands of readers the unwritten inference that history was repeating itself. Already, however, the Presidential election of 1924 had returned Calvin Coolidge, who had inherited the Presidency upon Harding's demise, by 382 electoral votes as against 136 for the Democratic nominee, JOHN W. DAVIS, and 13 for ROBERT M. LA FOLLETTE, candidate of a Progressive Party which vainly expected a large proportion of Republicans to bolt their old affiliations because of the corruption exposures or because of distress in the agricultural regions. In the Democratic Convention of that summer the KU KLUX KLAN, manifestation of a great wave of reaction which emphasized anti-Catholicism, Philistine morality, "America First," and "white supremacy" in degrees varying with the region, was active in preventing the nomination of ALFRED E. SMITH, liberal governor of New York. The influence of the nativist movement was evident in the sharp restriction of immigration under Harding and his successors. In 1928, however, anti-prohibition sentiment was on the increase and the Ku Klux Klan was waning; Smith captured the Democratic nomination, but in the face of ominous protest in the South against the nomination of a Catholic and a "wet." The election revealed that the nativist movement, especially in the South, was stronger than its typical organization; the Republican nominee, Hoover, received 444 electoral votes to Smith's 87, although his popular vote was a half-million under Harding's total. The new Administration and a majority of the public seemed to subscribe to the old doctrine of *laissez faire*, to permit big business to pursue wilful courses without regard to possible infringement of human rights as opposed to property rights; but in 1931 rays of liberalism emanated from an unexpected source, the Supreme Court, when the two most recent appointees, Chief Justice Hughes and Associate Justice OWEN J. ROBERTS, reversed anticipations by occasionally uniting with Justices OLIVER W. HOLMES, LOUIS BRANDEIS and HARLAN F. STONE to form a "5 to 4" majority.

Economic Advance and Recessions. Although the cessation of hostilities checked neither the prosperity of American business nor the sprouting of a new crop of millionaires, relations between capital and labor were turbulent in 1919. Over 4,000,000 wage earners were involved in strikes and lockouts; each of nine disturbances involved over 90,000 workers. The essential difficulty was that wages had not kept abreast with the ascending cost of living. The Railroad Wage Commission was busied in adjudicating a mounting number of disputes until Government operation of railroads, begun as a war measure on Dec. 28, 1917, was concluded by the Esch-Cummins Act of Feb. 28, 1920. This act, amid intricate provisions to guarantee a "fair return" to the owners, provided for arbitration of labor disputes in a manner offensive to the laborers; in retaliation for a wage reduction a nation-wide strike was begun on July 1, 1922, involving every important railway. In April of that year began a great coal strike, the first

to involve the anthracite and bituminous fields simultaneously; again the issue was wage reduction. Presidential intercession was in both instances without result. Public opinion forced the coal operators to capitulate; but the railway strike, hampered by a "blanket injunction" issued in September by a Federal judge in Chicago at the instigation of Attorney General Daugherty, failed. The subsidence of labor disputes coincided with the recovery of business from the economic depression of 1920-21, a period of deflation which had been inevitable when European buyers should exhaust funds and credit and the American public should react against the high cost of living by diminished purchasing.

Agriculture furnished a conspicuous exception to the recovery. An increase in 1922 of \$2,000,000,000 in crop values (\$7,028,000,000 in 1921, against \$15,423,000,000 in 1919) was insufficient to modify the marked inequality of the value of farm products with the cost of manufactured goods and with general living costs. A lowering of standards of living in rural areas and increase in the migration from farm to city were little checked by legislative measures which a farm bloc in Congress, about 100 representatives and 15 senators cooperating regardless of party affiliations, forced upon an apparently indifferent Administration. As it became recognized that the ruinously low prices for wheat, hogs and other staples of the Middle West and Northwest were traceable to a heavy export surplus of these commodities, the farm bloc demanded that the Government create a machinery to remove the surplus from the American market and so artificially balance domestic supply with demand. Intricate systems for that purpose were presented in the several McNary-Haugen bills, the third and fourth of which passed both Houses but were vetoed by Coolidge.

"Coolidge prosperity" was over two years old at the time of the second veto, May 1928; business was again in an upward stride, and plutocrats and white-collar men alike were speculating in common stocks. Coolidge and Secretary ANDREW MELLON periodically issued statements tending to bolster public confidence in the upward trend of the stock market; the banks of the nation, following the lead of the New York Federal Reserve Bank, pursued an inflation policy; professional economists joined business men and popular editorial columnists in subscribing to the theory of a "new economic era" in which good business could continue indefinitely to become better. The awakening came abruptly in Oct.-Nov. 1929; public statements and other endeavors of President Hoover to halt the decline in stock prices had a disappointing effect, and the depression proved of long duration. Business in general dropped sharply in Dec. 1929, and failed to make anticipated recoveries in 1930 or 1931. War veterans were enabled to borrow 50 per cent of the maturity value of their bonus certificates from the Government, and other specialized measures were enacted for relief from destitution or alleviation of unemployment; but the Administration feared to

sponsor any general measure which might savor of a dole to the jobless. The marked rise in the purchasing power of the dollar in 1931 signalized a readjustment toward an era of restricted profits and moderated expenditures.

Public Finance. The total cost of the World War to the United States, including \$9,500,000,000 loaned to the Allied nations, was about \$35,500,000,000, three times the total expenditures of the Government during its first hundred years. Five great bond issues, Liberty Loans and a Victory Loan, elicited \$21,435,370,600 from the public, and together with the sale of War Savings Certificates and Thrift Stamps in very small denominations gave the overwhelming majority of the American people some financial stake in the outcome of the war. The Democratic Congress refused to consider seriously the tariff as a source of war finances, but in the Act of Oct. 3, 1917 instituted an internal revenue program which included increase in income taxes, an excess profits tax on businesses, and many "luxury" and amusement taxes. The proportion of war revenue obtained from taxation exceeded that in any previous war, and exceeded that of any other power in the war.

The special session of Congress called by President Harding immediately after his inauguration was most concerned with fiscal readjustment: revision of the war taxes; the passing of the FORDNEY-McCUMBER TARIFF ACT, and of a Budget and Accounting Act for the better ordering of appropriations and expenditures; and the issue of a soldiers' bonus. Largely because of the urgings of the AMERICAN LEGION, a bonus bill passed both Houses in the spring of 1922, and narrowly failed of enactment over the President's veto. The Administration's attitude in 1922 as in 1924 was that while provision for the support and vocational retraining of wounded or sick veterans should be generous, a Federal gift to the able-bodied was undesirable on grounds of equity and economy. In the latter year, however, Congress enacted over Coolidge's veto a bonus measure representing a total estimated outlay of \$3,500,000,000, most of which was to be given veterans in the form of paid-up insurance.

Andrew W. Mellon, Secretary of the Treasury under the three Republican Presidents, effected a steady reduction of the public debt, and, although distinguished economists denied the wisdom of his course, approved agreements with the debtor Allies for the liquidation of their obligations to the United States on the best terms which he could obtain. Liaison between the Republican Administrations and the wealthy classes was evident; some observers discerned "dollar diplomacy" as again a dominant factor in the attitude of the Government toward the Latin-American countries. Friction with Mexico over the integrity of concessions to American capitalists and over the ownership of sub-soil rights continued until in 1927 the new ambassador to Mexico, DWIGHT W. MORROW, introduced a tactful course; Nicaragua was reoccupied by marines in 1926 after withdrawal in the previous year, marines remained in Santo Domingo

from 1916-24 (after which Americans continued to control the customs revenue), and are yet, 1932, in Haiti, for official reasons which have seemed inadequate to justify the expenses of intervention.

In 1922 over \$430,000,000 was hurriedly made available for agricultural financing, and further financial legislation followed in 1923, when a series of "intermediate credit banks" connected with the existing Federal Farm Loan Banks was established to offer more ample and flexible credits to the farmers. Agricultural depression was accelerated despite these measures and an emergency tariff act; the Hoover Administration attempted to meet the crisis in the wheat growing regions by means of a Farm Relief Bureau headed by ALEXANDER W. LEGGE, with extensive funds at its disposal for stabilization of the market price, but failed dismally. The HAWLEY-SMOOT TARIFF ACT of 1930 did not prove of general benefit. In Coolidge's second Administration the paradox of an economical executive and a wasteful Congress became increasingly evident; in 1930 and in the following year the Government exhibited an annual deficit of about \$1,000,000,000, largely ascribable to the failure of Congress to trim appropriations in accord with the economic depression. Secretary Mellon was forced to reverse his policy of reducing the public debt, and on June 15, 1931 offered an \$800,000,000 long-term bond issue. The issue was oversubscribed, partly because, as a newspaperman expressed it, "while the treasury may have a deficit the credit of the Government is A-1 gilt edged." In September, however, the offering of a similar amount was oversubscribed by only a narrow margin. The Administration decided to substitute as far as possible a system of increased taxation in lieu of further borrowings; and when Congress met on Dec. 7, 1931, the President transmitted with his annual message a program for increased revenues drawn up by the Treasury Department, based on the "war taxes" of the previous decade. The fact that off-year and special elections, reflecting the rapidly increasing disapproval of prohibition as well as the dissatisfaction with the party in power which usually accompanies a financial depression, had transmitted control of the House of Representatives to the Democrats, made evident that whatever emergency measures were enacted would be the result of painful compromise. E. D. B.

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UNITED STATES and MACEDONIAN, two warships which engaged in a combat Oct. 25, 1812,

resulting in an American naval victory in the WAR of 1812. The frigate *United States*, with 54 guns and 478 men under Capt. Decatur, sailing northeast from Boston, descried the British ship *Macedonian*, with 49 guns and 300 men under Capt. Carden, and gave pursuit. Its second broadside found the range, and drew British fire; the ensuing cannonade seriously damaged the *Macedonian*, and the vessel attempted action in close quarters. The incessant cannonade by the *United States* was again effective, and two hours after the first fire Carden struck colors. The hull alone of the *Macedonian* had received over 100 round shot; 36 of its officers and crew were killed, and 68 wounded. The American loss was five killed and 11 wounded.

UNITED STATES COAST GUARD, THE.
See COAST GUARD.

UNITED STATES COAST GUARD ACADEMY. See COAST GUARD ACADEMY.

UNITED STATES EDUCATION STATISTICS. The educational system of the United States as distinguished from those in most other countries is built up on the vertical plan, each type of school being articulated with the next stage, and provides equality of opportunity for all. The large majority of pupils attend public schools. The following statistics, for 1929-30 unless otherwise indicated, will give a picture of the whole system with some indications of the variations in different parts of the country. The figures are based on the *Biennial Survey of Education*, 1929-30, published by the United States Office of Education.

General. Of the total population, 122,775,046, on the year ending July 1, 1930, there were enrolled in public kindergartens and elementary schools, 21,278,593 pupils (10,842,259 boys and 10,436,334 girls), and in secondary schools, 4,399,422 pupils (2,115,228 boys and 2,284,194 girls). The number of children of school age, 5-17, was 29,994,458, of whom 25,678,015 pupils or 85.6 per cent were enrolled in some public school. The average daily attendance was 21,284,886 or 82.89 per cent.

Kindergartens. Reports from 417 cities stated that they maintained 7,124 kindergartens with 586,525 children enrolled and an average daily attendance of 362,495. The number of teachers employed was 10,380. Of the 7,124 kindergartens 4,129 were provided in cities of over 100,000 population, or Group I cities; 1,669 in cities of 30,000 to 100,000 population, Group II cities; 1,326 in cities of 10,000 to 30,000 population, Group III cities. The total enrollment in kindergartens throughout the country was 723,443.

In addition to kindergartens there have recently developed nursery schools. In 1931-32 there were 203 such schools located in 121 cities and in 36 states and the Territory of Hawaii. Only a very small number of these are as yet provided as a part of the public school system. Of the rest the majority are private, and some serve as demonstration or teacher training centers in departments of home economics and education in colleges and universities. Others are used as

laboratories for institutes of research in child development.

Elementary Schools. The total enrollment of pupils in public elementary schools was 21,278,593 distributed by grades as follows: First Grade, 4,150,919; Second, 2,802,914; Third, 2,732,239; Fourth, 2,599,229; Fifth, 2,382,491; Sixth, 2,256,249; Seventh, 2,029,736; and Eighth, 1,601,373. The average length of school term was 172.6 days (for the 48 states reporting), with a range from 133.4 days to 188.4 days. The average number of days attended by each pupil was 143 days with a range from 97.7 days to 163.1 days; the percentage of average daily attendance was 82.9 with a range from 72.5 per cent to 89.4 per cent. The number of buildings used for elementary school purposes was 238,383. The total number of teachers employed was 854,263 (141,771 men and 712,492 women). In cities with populations above 10,000 (722 cities reporting with a total population of 45,161,468) the total enrollment in elementary schools was 9,953,313 with an average daily attendance of 8,370,664 or 84.1 per cent. The total number of teachers was 292,299 (38,674 men and 253,625 women).

Secondary Schools. In 1930, 18,116 public high schools reported a total enrollment, including seventh and eighth grade pupils, of 5,212,179 (2,522,816 boys and 2,689,363 girls). The distribution of the pupils in the four years of the regular high school course was as follows: first year, 1,460,459; second year, 1,132,061; third year, 852,012; fourth year, 684,985. Of the total enrollment 157,515 were colored pupils (62,150 boys and 95,365 girls) taught in 715 schools. In 14,118 of the high schools reporting 591,719 pupils were graduated in 1928 (267,298 boys and 324,421 girls). The total number of teachers employed in all types of high schools was 189,222 (68,738 men and 120,484 women). The high school program has been so expanded that enrollments are now reported in 250 different subjects.

Teacher Training Institutions. Teacher training is provided in 331 institutions including 140 teachers' colleges, 66 state normal schools, 26 city normal schools, 47 county normal schools, and 52 private normal schools. The total enrollment in these institutions was 279,195 (60,935 men and 218,260 women). The number of graduates from non-degree courses was 49,227 (7,038 men and 42,189 women); the number of bachelor's degrees conferred 11,073 (3,609 men and 7,464 women). The total number of instructors was 14,473 (5,995 men and 8,478 women).

Private Schools. The enrollment in private and parochial elementary schools and kindergartens was 2,255,430 and in private high schools and academies 341,158, of whom 204,787 were in denominational schools. The total number of teachers employed was 83,355 (9,623 men and 73,732 women). The total expenditure on private schools including outlays was \$228,258,290.

Miscellaneous Statistics. The total number of adults receiving instruction as reported by state de-

partments of education was 262,308. In industrial schools for delinquents the enrollment in 1927 was 84,317; in schools for the deaf, 17,496; in schools for the blind, 6,084; in schools for the feeble-minded and subnormals, 104,021. The total number of students in summer schools and other types of courses offered by universities, colleges and professional schools was 631,744. Of these 249,050 were in summer schools, 10,078 in short winter courses, 195,549 in extension courses, and 88,417 in correspondence courses.

Financial Statistics. The total amount expended for public school education for 1927-28 was \$2,314,527,645, including both current expenditures and capital outlays. This represented more than twice the cost for 1919-20, \$1,036,151,209. The total expenditure amounted to \$108.40 for each child in average daily attendance. The value of public property for school purposes was \$6,211,327,040 or an average of \$242 per pupil enrolled. The permanent school funds were \$463,118,007, and the value of unsold school lands \$446,670,403, together yielding receipts amounting to \$27,516,517. The income from appropriation and taxation was \$1,975,000,085 (\$329,312,434 state, \$209,331,343 county, and \$1,436,356,308 local). The total revenue receipts available for educational purposes including Federal aid for vocational education was \$2,088,556,837. The expenditure for general control was \$78,724,010; for instruction, \$1,316,476,266; for operation of school plants, \$215,955,760; and for maintenance, that is, upkeep charges, replacements and repairs, \$78,677,176. The total expenditures for current expenses and outlays were \$2,305,016,106. The average annual salary of teachers was \$1,419.

In city school systems (Group I, II and III) the receipts amounted to \$1,455,852,196 and the expenditures to \$1,289,003,204. Of this sum \$19,912,486 was spent for kindergartens; \$379,053,705 for elementary education, \$262,137,214 for junior and senior high schools; \$2,711,989 for normal schools, and \$6,672,286 for vocational schools. The average annual cost of instruction per pupil in elementary schools was \$69.01. The average salary of teachers in elementary schools was \$1,838, in junior high schools \$2,039, and in high schools \$2,467. The per capita costs including all current expenses except interest payments and based upon average daily attendance ranged in a number of typical cities as follows: Group I from \$63.06 to \$162.15; Group II from \$42.70 to \$196.16; and Group III from \$29.77 to \$228.47.

The value of buildings and grounds of teacher training institutions was \$226,456,814, and the endowment funds were \$24,392,741. The total receipts from state, city and county sources was \$69,983,932.

For statistics of higher education see UNIVERSITIES AND COLLEGES. I. L. K.

See United States Office of Education, *Bulletin*, 1930, No. 16, *Biennial Survey of Education*, 1928-30, 1932.

UNITED STATES GEOLOGICAL SURVEY, an independent bureau of the Interior Department, charged with important conservation and reclamation services, as well as with the construction of a great

topographical and geological map of the United States and its possessions. As created by Congress in 1879, the Survey was restricted to public lands. In 1888 its field was extended to embrace the entire country. In that year was begun the important Powell Irrigation Survey of arid lands. From the first concerned with gathering data on standing timber, in 1897 the bureau embarked on an extensive survey of national forest reserves. For some years previous to the organization in 1910, of the Bureau of Mines and the Bureau of Standards, the Survey investigated causes of mine disasters and analyzed and tested fuels and building materials. Since 1906 it has been entrusted with the classification and valuation of public lands. As at present constituted, the Survey has seven distinct functions: 1. Topographical survey; 2. Report on mineral resources; 3. Mineralogical survey; 4. Surveys relating to water resources and protection of navigable streams; 5. Examination of lands proposed for purchase by the Government; 6. Valuation of public lands; 7. Map engraving and lithography.

About half a million copies of the Survey's five-cent topographical maps in color are sold each year, their minute detail, clearness and accuracy making them of great value in engineering, mining, and industrial projects, as well as to the ordinary traveler. Single sheets showing one "quadrangle" are published on the scale of one mile to an inch for thickly settled regions, two miles for the country at large, and four miles for desert areas, where routes from one waterhole to another are carefully indicated. Geological maps are also available at low cost. Eminent geologists have served as directors of the Survey, and also upon its scientific staff. The Survey has cooperated freely with the War and Navy departments, with numerous state surveys, and with the Isthmian Canal Commission.

UNITED STATES MILITARY ACADEMY, a school for the practical and theoretical training of cadets for the military service, situated on the Hudson River at West Point, New York. Upon completing its course satisfactorily, cadets are eligible for commission as second lieutenants in the Army.

The supervision and charge of the Academy are in the War Department, under such officer or officers as the Secretary of War may assign to that duty. The Chief of Staff has been by direction of the Secretary of War charged with the supervision of matters in the War Department pertaining to the Academy. An officer, usually a general officer, is designated by the Secretary of War as Superintendent of the Academy for a period of four years.

The Corps of Cadets is organized into three battalions under the Commandant of Cadets, assisted by three battalion commanders, army officers, each company being commanded by an officer of the army. Cadet officers and noncommissioned officers are selected from those cadets having the highest rating in military efficiency and conduct. Captains, lieutenants, 1st sergeants and sergeants are selected from the 1st Class and the corporals from the 2nd Class.

The cadets are arranged in four distinct classes corresponding with the four years of study. The cadets employed on the first year's course constitute the Fourth Class, or Plebe Class as they are called; those on the second year's course, the Third Class or yearlings; those on the third year's course the Second Class; and those on the fourth year's course the First Class.

The academic year commences on the 1st of July. Academic duties are suspended from the completion of the June examinations until the end of Aug. During this period cadets are engaged in military duties and exercises and in reviewing practical instruction in military and other subjects.

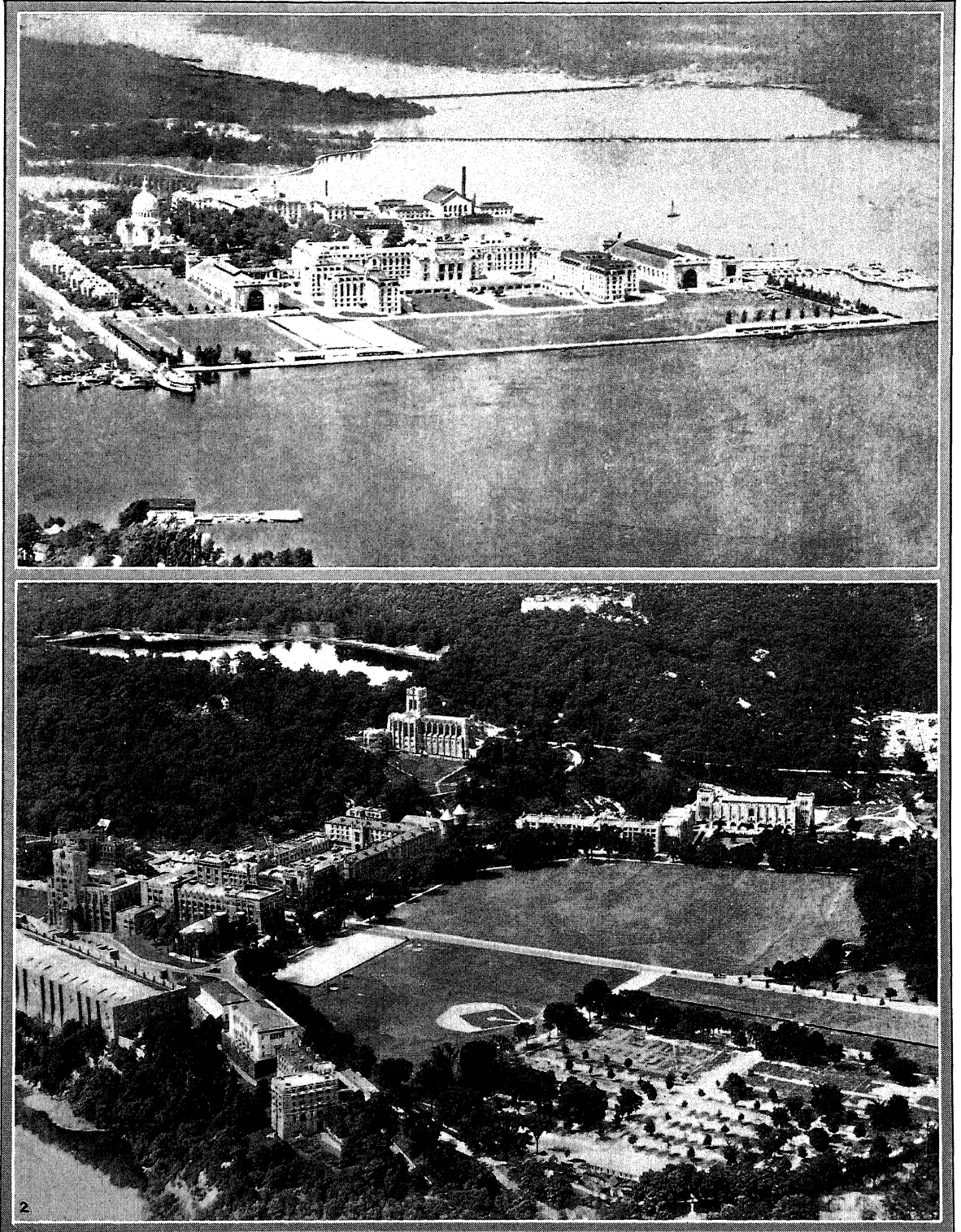
Cadets of the 1st, 2nd and 3rd classes not undergoing examinations are allowed leaves at Christmas. Cadets of the 1st Class are also granted six week-end or holiday leaves throughout the year. Excepting such leaves, cadets under ordinary circumstances are allowed but one leave of absence during the four-year course. This leave is granted to those cadets who have successfully completed the third class course of study and extends from the middle of June until the 28th of Aug. Cadets are paid at the rate of \$1,072 per annum during the time they are in the Academy.

The age of cadets entering the Academy is between 17 and 22. They are appointed as follows: Two from each Congressional district; two from each Territory; four from the District of Columbia; two from Porto Rico; four from each state at large, and 122 from the United States at large, two of whom are appointed upon the recommendation of the Vice President, and 20 of whom are selected from among the honor graduates of educational institutions having officers of the regular army detailed as professors of military science and tactics. They are appointed by the President and are, with the exception of the 122 appointed from the United States at large, actual residents of the Congressional or Territorial district, respectively, from which they purport to be appointed. The President is also authorized to appoint cadets from among enlisted men, in number as nearly equal as practicable, from the regular army and National Guard, between the ages of 19 and 22 years, who have served as enlisted men not less than one year. The total number so selected shall not exceed 180 at one time, and the maximum number of cadets is 1,374.

The occupation of West Point as a military post took place on Jan. 20, 1778, and has been continued since that date. The earliest proposal for a military school for the United States was that made in May 1776 by Brigadier General Henry Knox, Chief of Artillery. His plans were seconded by Colonel Alexander Hamilton and approved by General Washington, though they were not adopted in the form suggested before 1802, other counsels having temporarily prevailed.

An Act of Congress in 1802 authorized the President to organize a Corps of Engineers, consisting of five officers and ten cadets, and provided that it should be stationed at West Point, N.Y., and should

UNITED STATES ACADEMIES



1. COURTESY UNITED STATES NAVY DEPT.: 2. EWING GALLOWAY PHOTO

GOVERNMENT TRAINING SCHOOLS FOR THE ARMY AND NAVY

1. United States Naval Academy, Annapolis, Maryland.
2. United States Military Academy, West Point, New York.

constitute a Military Academy. The Academy with ten cadets present was formally opened July 4, 1802.

By Act of Congress of Apr. 29, 1812, the Academy was reorganized. The provisions of this act have furnished the general principles upon which the Military Academy has since been conducted and controlled; a more adequate corps of professors was authorized; a maximum of 250 cadets was fixed; and the age and the mental requisites for admission were prescribed.

In 1817, under the provisions of the Act of 1812, and the able superintendency of Major Sylvanus Thayer, Corps of Engineers, the present era in the Academy's history opened. S. J.

UNITED STATES NATIONAL MUSEUM.

This museum, in the city of Washington, although under direction of the Smithsonian Institution, is supported wholly by Congressional appropriations. It is an outgrowth of the Institution, and fills three large buildings in its grounds, the first one, built of brick, and completed in 1881, proving inadequate long before the second granite edifice was completed in 1911. Recently Congress has authorized the construction of two wings on the Natural History Building at a cost of \$6,500,000. The collections began with a constantly growing influx of specimens illustrating the natural resources of the new West, gathered by governmental and scientific surveys early in the 19th century, and steadily augmented since, largely by gift. Hence this museum, in addition to its immense exhibits in American natural history, broadly interpreted, has become foremost as a place for intensive study in that field of knowledge.

The National Museum also became the depository of the accumulation by the Bureau of American Ethnology of material illustrating the prehistory and the life and customs of the American Indians, such as pottery, baskets, ornaments, and other objects, a most interesting display. Another specialty is the preservation of historical materials relating to the social development of the United States, particularly personal mementos of notable figures in our history. Industrial progress and its advance in the arts and conveniences of life are represented here by exhibiting the beginnings and subsequent development of certain machines of general interest, such as those concerned with transportation, electrical inventions, aviation and the like. Supplementing the wealth of facts and ideas set forth in the well-labeled cases, much scientific study is in progress in its laboratories, the results of which are published in series of *Proceedings* and *Bulletins*, distributed free to libraries, educational institutions, and specialists which are of high scientific and educational authority and value. E. I.

UNITED STATES NAVAL ACADEMY, the training school for naval officers opened at Annapolis, Md., Oct. 10, 1845. The War Department had transferred to the naval authorities the site and buildings of Fort Severn, one of the defenses of Annapolis harbor. The first step was to collect the midshipmen that, from time to time, were on shore, and give them

instruction in subjects essential to the education of a naval officer. In Oct., 1849, the course of instruction and the regulations were revised, the institution was entitled the U.S. Naval Academy; and in Nov., 1851, the course of study was fixed at four years. A practice-vessel was attached to the Academy for summer cruising. At the breaking out of the Civil War, May, 1861, the Academy, with all its apparatus and personnel, was transferred to Newport, R.I., where it remained until Sept., 1865, when it was returned to Annapolis. The program of studies was rearranged, and remains practically unaltered to the present time. The course of instruction now embraces seamanship and flight aeronautics; ordnance and gunnery; navigation; engineering and aeronautics; mathematics; electrical engineering and physics; English and history; modern languages; physical training and hygiene.

A student of the Naval Academy is called a **MIDSHIPMAN**. Four midshipmen are appointed by the Vice President and by each Senator, Representative and Delegate in Congress; one from Porto Rico, a native of the island, is nominated by the Governor; four by the Resident Commissioner from Porto Rico; two from the District of Columbia, and 15 appointed each year from the United States at large. In addition, one Filipino is allowed for each class. The appointment from the District of Columbia and 15 each year at large are made by the President.

The selection of candidates, by competitive examination or otherwise, for nomination for vacancies in the quota of Senators, Representatives and Delegates in Congress is entirely in the hands of each Senator, Representative and Delegate in Congress having a vacancy. Two examinations for admission are held each year, the first on the third Wednesday in February, the second on the third Wednesday in April.

The law authorizes the appointment of 100 enlisted men each year, to be selected as a result of a competitive examination of enlisted men of the regular Navy and Marine Corps who will have been in the service at least one year by July 1 of that year.

The law also authorizes the appointment of 25 midshipmen each year, to be selected as a result of competitive examination of enlisted men of the Naval Reserve and the Marine Corps Reserve. Candidates must be citizens of the United States who have been in the Naval Reserve at least one year by July 1 of the year in which appointed. The competitive examination of these enlisted men is held on the third Wednesday in April of each year. Candidates may also be accepted on certificate.

An act of Congress approved June 8, 1926, authorizes that the number of midshipmen then allowed by law at the United States Naval Academy be increased by 40 from the United States at large, to be appointed by the President from among the sons of officers, soldiers, sailors and marines of the Army, Navy and Marine Corps of the United States who were killed in action or died prior to July 2, 1921, of wounds or injuries received or disease contracted in line of duty during the World War.

Candidates must not be less than 16 nor more than 20 years of age on April 1 of the calendar year in which they enter.

The Academy is well located at Annapolis. Its area has been increased from time to time, and in 1902 Congress appropriated sufficient funds for a number of new buildings and quarters, so that the older ones have gradually been replaced.

In connection with the Naval Academy, and under the supervision of the Superintendent, is the Postgraduate School for student officers.

The station ship in 1931 was the U.S.S. *Reina Mercedes*, taken from Spain during the Spanish War.

It may be of interest to note that the body of John Paul Jones, which was brought from France in 1909, now rests in the Chapel of the Academy. R. E. C.

UNITED STATES WEIGHTS AND MEASURES. See WEIGHTS AND MEASURES, UNITED STATES.

UNITED WORKMEN, ANCIENT ORDER OF, a fraternal, beneficiary society founded in 1868. It aims to carry out the precepts of its motto "Charity, Hope and Protection." The society is divided into more than 20 grand lodges and 1,950 subordinate lodges with the governing board concentrated in the supreme lodge. A member must pass through three degrees before he attains full membership and is permitted to take out insurance.

UNIT HEATER, a combination of heating elements and a fan or blower enclosed in a casing so that the fan will force or draw the air over the heating surface and discharge it in a definite direction. Unit heaters are usually placed in the room to be heated, are supplied with either steam, hot water or electricity and will distribute heat for distances of 60 to 300 feet. Unit heaters are rated in British Thermal Units output per hour at a given air temperature and steam pressure.

UNITS, ELECTRICAL. See ELECTRICAL UNITS.

UNITS, PHYSICAL. See PHYSICAL UNITS.

UNIVERSALIST CHURCH, that denomination of Christians who hold the belief of universalism, namely, that all mankind eventually will be saved or restored to holiness and happiness. The Church is chiefly confined to the United States, although its distinctive religious belief has been preached in various times and places by men in other denominations. Universalists claim that their doctrine of a beneficent universe was taught in the early Christian schools at Alexandria, Edessa and Antioch in the 2nd and 3rd centuries and was accepted by such Fathers as Clement of Alexandria, Gregory of Nyassa, Origen and others.

The Universalist Church in the United States dates from 1770, when the Rev. John Murray arrived from London and began to propagate the doctrine in New York, Pennsylvania and Massachusetts, in all of which states churches were early established. His first parish was at Gloucester, Mass., where a church was built in 1780. A gathering of Universalists five years later at Oxford, Mass., approved the name selected by the Gloucester church, namely, "The Independent Christian Society, commonly called 'Universalists'," and a

second convention held in Philadelphia in 1790, adopted the first Universalist profession of faith. The establishment of Universalism as a Christian sect owes most to the learning and indefatigable preaching of Hosea Ballou (1771-1852), who was the honored leader of the movement for 50 years. During his ministry the 30 churches increased to 500, chiefly in New England, New York, Pennsylvania, Ohio, Indiana and Illinois, which still have the strongest and largest number of Universalist churches.

The polity of the churches is essentially congregational, in that each church is independent in the management of its own temporal affairs. Adherence to state and General conventions, however, is required in the matter of belief and in the employment of a pastor, and since 1898 a system of state and general superintendents has been adopted. In doctrine most of the churches conform to what is known as *The Winchester Profession*, or to the *Statement of Essential Principles*. The Profession dates from 1803, and stresses the Bible as a revelation of the character of God, man's duty and final destination. The *Statement of Essential Principles* dates from 1899, when it was adopted in Boston, stressing the "universal Fatherhood of God, the spiritual authority and leadership of His Son, Jesus Christ, the trustworthiness of the Bible as containing a revelation of God, the certainty of just retribution for sin, and the final harmony of all souls with God." But a liberty clause was added stating that "neither this nor any other precise form of words shall be required as a condition of fellowship." In 1931 there were between 400 and 500 churches, with an aggregate membership of about 50,000.

UNIVERSAL POSTAL UNION. For some time after the establishment of fairly satisfactory national postal systems there still remained many annoying and inconvenient obstacles in the path of efficient transit and delivery of international mails. To remedy the evils the United States in 1862 suggested the calling of an international conference of posts, and in 1863 such a congress was held at Paris. The gathering drew up a code of 31 articles which was to serve as the basis for a series of international postal conventions, but the vicissitudes of the American Civil War and the various European wars between 1864 and 1871 prevented, or at least postponed, further progress. Interest in the reform movement, however, remained alive, particularly in view of the successful functioning in the 1860's of a postal union between Austria, Prussia, and some twenty other German states. Upon the invitation of the Swiss Government, therefore, another meeting was held at Berne, in Sept., 1874. Twenty-two states, including the United States and Egypt, attended.

The Berne congress drew up the first International Postal Convention which, with modifications and amendments, still remains in force. By the terms of this agreement the members of the International or Universal Postal Union contracted to consider themselves, for the purpose of mail delivery, as one large

postal territory, and each member bound itself to dispatch as efficiently as possible the mails coming from and going to every other member. The membership of the Union increased rapidly, China being the latest of the large powers to adhere in 1914. After the World War Soviet Russia temporarily dropped out of the group, but it soon was readmitted. Thousands of millions of pieces of mail are delivered each year by the members of the Union.

The Union maintains a central office or bureau at Berne, where relevant information is available, statistics are collected, and lists of mail delivery services are obtainable. The state memberships cost from \$75 to \$1,750 a year, and there are periodical conferences at which changes and improvements are discussed and voted upon. Any international question or difficulties that may arise are settled either by special conventions between the disputants or else by compulsory arbitration.

UNIVERSAL SOLVENT, another name for the ALKAHEST, a substance which would dissolve all other substances. See ALCHEMY.

UNIVERSE, STELLAR, that part of the material universe made up of the stars, star-clusters, spiral nebulae and stellar systems that can be reached by direct observation. With the telescopes available at present this universe can be explored to a depth of about 1,000,000,000 light years.

UNIVERSITIES AND COLLEGES. These terms, now used to refer to institutions devoted to higher education and research, were originally applied to any corporate body. Although institutions for advanced study existed during the Roman Empire at Athens, Rhodes, Alexandria and Marseilles, the origin of the modern universities and colleges is to be found in the Middle Ages, in some cases as outgrowths of cathedral or monastic schools, in others from the informal gathering of students around a great teacher, as Irnerius at Bologna, and Abélard and Peter Lombard in Paris. Their development was stimulated by the revival of interest in the 11th and 12th centuries in such subjects as Roman law, canon law, medicine and dialectic philosophy, and interest which at that time had a definitely practical bent. Such early centers of learning sprang up first at Salerno (medicine) in the 11th century, Bologna (law), and Paris (philosophy and theology) in the 12th. The name for such a center was *studium generale*; the term applied to the body of students was *universitas scholarium* or *universitas magistrorum*. Practice varied; at Bologna, where the students were more mature, they constituted the *universitas*; in Paris, where the students were quite young, the masters. In time the term came to be applied to the whole institution.

General Organization. The general organization of a university followed that of the contemporary guilds, that is, the students had to pass through a period of apprenticeship to become masters and a further period to become doctors in the more advanced studies such as theology, law and medicine, although originally the three titles magistrate, doctor, and

professor were synonymous. During the period of apprenticeship the student became a *baccalaureus*, the origin of the bachelor's degree. The length of study varied, however, in different centers and at different times. The development of the universities was fostered by the granting of privileges either from a locality in order to retain the students or from the state in the form of exemptions from taxation and military duties, or from the Pope or Emperor, as in the Holy Roman Empire, in the form of charters. From the early 13th century on, the practice whereby promotions to degrees were controlled by the masters' guild was superseded by the requirement that the consent of the chancellor must be obtained, an assertion of the right of the Church to control education. Degrees entitled their possessors to teach at first locally and later anywhere, *jus ubique docendi*. The studies of the medieval university were organized into four faculties: arts, theology, medicine, and law.

The widespread interest in higher education is evidenced by the fact that 79 universities were established from the earliest foundation in the 12th century to 1500. Among the oldest surviving universities are Pavia, Bologna, Paris and Montpellier, 12th century; Oxford, 1167-68; Cambridge, 1209; Padua, 1222; Naples, 1224; Salamanca, before 1230; Rome, 1333; Prague, 1347-48; Cracow, 1364; Vienna, 1365; Heidelberg, 1385; Leipzig, 1409; St. Andrews, 1413; Glasgow, 1451; Upsala and Copenhagen, 1477; and Aberdeen, 1494.

The more limited application of the term college, *collegium*, to an educational institution was derived first from its use in referring to the organization of teachers and doctors at Bologna for the purpose of granting degrees, and secondly and more generally from the grouping of students in residential halls. Provision began to be made early for the housing of poor students in hospitals and monasteries; later special halls were established not only for poor but for any students who desired to join. These halls came to be known as colleges or corporations. Established first to provide facilities for board and residence, the colleges gradually began to offer lectures and tuition, and in time some, like the Sorbonne, about 1250, and the colleges at Oxford and Cambridge, became more important scholastically than the universities of which they formed a part.

Scholasticism, the characteristic method of medieval philosophy, dominated the universities even after the Renaissance had ushered in new studies and new methods; humanism did not influence the universities until later. The Reformation at first seriously affected both the attendance and the resources of the universities, and yet both this movement and the Counter-Reformation stimulated the creation of a large number of new universities in the 16th century. Since the universities tended to follow a traditional routine and to look askance at the introduction of new subjects and of the vernacular, these began to be cultivated by independent academies and LEARNED SOCIETIES. In general, although exceptions can always be cited,

the universities everywhere were at a low ebb in the 17th and 18th centuries.

First Modern Universities. The first modern universities to be established on the principle of genuine academic freedom and for the promotion of new studies and research were those at Halle, 1694, and at Gottingen, 1737. The revival and modernization of the German universities followed in the period of reconstruction following the defeat at Jena; the University of Berlin was created in 1809 and the University of Bonn in 1818. In France the universities which were almost moribund were abolished by the Revolution, only to be revived in 1806 by Napoleon as a collection of 15 faculties constituting the University of France and devoted to the promotion of professional and practical studies. The French universities were given their modern organization in the last decade of the 19th century.

There are at present in France 17 universities. All have faculties of letters and sciences; but the faculties of law, medicine and pharmacy are not found in all. The total enrollment in all faculties in 1928-29 was 64,531, the faculty of law having the largest number. There are besides the universities a number of other state institutions of similar rank known as *Grandes Ecoles*, several private universities, mainly Catholic, with some or all of the faculties, and some higher vocational institutions.

In Germany there are 23 universities with faculties of theology, jurisprudence, medicine and dentistry, philosophy, mathematics and natural sciences, and other sciences. The total enrollment in the winter semester of 1928 was 83,172. There are in addition 10 technical high schools of university rank with 20,495 students in 1928, and many higher institutions for research in special fields.

England. In England the revival of the universities of Oxford and Cambridge began at the close of the 18th century and was led by small groups of leaders who addressed themselves first to the improvement of the standards of studies and examinations. Internal reforms continued to be made during the first half of the 19th century; later reforms followed on investigations conducted by special commissions appointed by the Government. The demand for more facilities for higher education was met by the establishment of University College, London, in 1828, and King's College, London, in 1831, both of which were affiliated with the University of London, chartered in 1836 as an examining body. The University of Durham was chartered in 1837 and was followed by the establishment of a number of university colleges out of which independent universities were later created: Victoria University, 1880; University of Wales, federated, 1893; Universities of Birmingham, 1900; Liverpool and Leeds, 1903; Sheffield, 1905; Bristol, 1909; Reading, 1926. A number of university colleges, Exeter, Hull, Nottingham and Southampton, which do not yet possess their own charters, prepare their students for the examinations of the University of London. (See also WOMEN, EDUCATION OF.)

The total enrollment of students in the 11 English universities in 1928-29 was 33,871; the total of Great Britain was 48,645, not including the students in university colleges, women's colleges, the Inns of Court, and other special institutions for higher education. The more usual faculties found in the universities are arts, science, medicine, law, engineering, commerce, music and theology. For undergraduate students in arts and sciences two types of courses are generally provided: a general, pass, or ordinary course permitting the somewhat extensive study of a large number of subjects, and an honours course requiring the intensive study of some special or allied subjects.

The United States. The first American college, Harvard, was founded in 1636 by a group of men educated at Emanuel College, Cambridge. The College of William and Mary followed in 1693 and Yale College in 1701; then Princeton, 1746; King's, later Columbia, 1754; University of Pennsylvania, 1757; Brown, 1766; Rutgers, 1766; and Dartmouth, 1770. The chief characteristics of the early colleges were that they were sectarian institutions directed primarily to give preparation for the ministry, that they transplanted the work of English colleges, and offered a prescribed traditional course leading to the A.B. degree. The courses were gradually expanded after the middle of the 18th century by the addition of mathematics, and some sciences, with the intention of meeting more closely the new needs of the day. Preparation now began to be given for the professions of law and medicine. The institution which later became the University of Pennsylvania was definitely established in a liberal spirit, which through the influence of Jefferson was also introduced at William and Mary in 1779. Jefferson's interest in democratizing educational opportunities marks a further development in the creation of the University of Virginia in 1825 to meet the needs of every citizen, rich and poor.

While the earlier colleges had been established through private philanthropy and with denominational aims, a practice which continued throughout the 19th century, there developed out of the more general desire after the Revolution to spread the influence of education another tendency, affected in part by the doctrines of the French theorists, to provide education at public expense. The Ordinance of 1787 distributed lands to the states to be used for educational purposes. Out of this grew a movement for the establishment of state universities. The University of Georgia was established in 1785; the foundations of what later became the University of Michigan were laid in 1817; Indiana University was begun in 1820. Other state institutions following were Alabama, 1831; Wisconsin, 1836; Vermont, 1838; Missouri, 1839; Mississippi, 1844; Iowa, 1847, and Florida, 1856. After 1862 the Morrill Act stimulated through Federal land grants the establishment of Colleges of Agriculture and mechanic arts as a result of which old institutions were strengthened and new ones created.

The development of higher education during the 19th century was concerned with two important problems. The first was the adaptation of the college work to the newly developing needs of the country and the constantly increasing body of students. New subjects were added slowly; modern languages began to receive recognition from 1820-30; the sciences were introduced from time to time. The types of degrees began to be differentiated, and a number of new ones were added to the traditional A.B.; thus the Ph.B. was introduced at Brown, 1851; Yale, 1852; Columbia, 1864; the B.S. at Harvard, 1851; Dartmouth, 1852; Michigan, 1853; Cornell, 1868; Amherst, 1872, and Princeton, 1873. The establishment of Lawrence College at Harvard and Sheffield College at Yale about 1850 are indicative of the desire to promote scientific study.

The expansion of the curriculum tended only to aggravate the situation, and the desirability of prescribed courses began to be questioned. The solution was found in the adoption of the system of electives, introduced from the start at the University of Virginia, 1825, recommended by Prof. George Ticknor at Harvard in 1825 and adopted by the Corporation in 1838. The principle of electives received the support of the great leaders in the history of higher education in the 19th century. Pres. Wayland of Brown, Pres. Eliot of Harvard, Pres. Barnard of Columbia, and Pres. Tappan of Michigan. The practice of electives varied in different institutions. Prescribed courses were retained in some and part of the course was made elective; in others elective courses were offered; in others again the right of election extended to all subjects usually with the exception of English.

The establishment of the first colleges was influenced by English practice; the second period, the founding of state institutions, by French theory and practice. The second of the two problems referred to above concerned the provision of advanced study beyond the undergraduate levels. Here the influence was distinctly German and was exercised by a number of Americans who had studied in the German universities early in the 19th century. It was generally felt that the American colleges were still devoting themselves to instruction which in foreign countries is regarded as secondary. What was demanded was the creation of opportunities for graduate study and for research investigation. Graduate work was provided at Yale in 1847; but a graduate department as such was not created until 1872. Nine years after its establishment at Harvard and four years after Cornell, Johns Hopkins University was definitely established in 1876 on the model of the German universities to promote graduate study and research. (See GRADUATE SCHOOLS.) In 1890 a graduate faculty of philosophy and political science was organized at Columbia and a faculty of pure science added in 1893. In 1892 the University of Chicago was opened with a strong emphasis on graduate studies. Since the beginning of the century facilities for graduate work have multiplied in many private institutions

and in most state universities. Strictly speaking the term university should refer only to institutions providing graduate, as well as undergraduate, work. There are, however, many institutions in the country which though called universities have no facilities for advanced work, and many others which offer work beyond the bachelor's degree which continue to call themselves colleges.

The first 30 years of the present century were devoted to problems of standardization and further adjustment to the rapidly increasing body of students. To the standardization not only of colleges and universities but also of professional schools a number of private organizations, like the Carnegie Foundation for the Advancement of Teaching (see CARNEGIE TRUSTS) and the GENERAL EDUCATION BOARD, and associations, like the AMERICAN COUNCIL ON EDUCATION, American Association of Teachers Colleges, Association of American Colleges, Association of American Universities, American Medical Association, American Association of University Women, the North Central Association, the American Association of University Professors, and the National Association of State Universities, among others, have largely contributed. These organizations have discussed such questions as college entrance requirements and college curriculum. The question of college entrance requirements is being met in a variety of ways: by accrediting systems; by examinations, e.g. those conducted by the College Entrance Examination Board; by examinations and scholastic records, and by psychological tests combined with one or more of the other methods. The curriculum question involves, first, adjustment to the needs of the large body of students which is being met in part by many experiments especially in the guidance and advice of students, by orientation courses, and by modifications of the elective system; second, the raising of standards of achievement which is being accomplished in some instances by the introduction of comprehensive examinations, in others by special provisions for abler students.

There is at present considerable experimentation in the college field. Swarthmore College and many other institutions have introduced honors courses, which permit more intensive specialization than is usual in the last two years. Antioch College has undertaken an experiment which combines work in gainful occupations and study. Rollins College is endeavoring to improve standards of work through closer cooperation between the faculty and the students. In another direction there is developing a movement for the establishment of JUNIOR COLLEGES, either independent or as extensions of high schools, which are intended in part to take care of the increasing body of students who can profit from two years of college work beyond the high school and in part for those who can complete their general education in this way and proceed to some other institution for professional or other specialization.

A distinguishing feature of higher education in the

United States is the number and variety of degrees granted. Bachelor's degrees are granted in arts, science, philosophy, systematic theology, divinity, agriculture, engineering; master's degrees in arts and science; and the doctor's degrees in philosophy, laws, divinity, medicine and science. Still another characteristic is the form of government. In the European universities, even when state controlled, the faculties participate in the administration of their internal arrangements. The American universities are governed by a self-perpetuating board of trustees or by an appointed board of regents or trustees in the case of state institutions, who are responsible for general financial administration, salaries and appointments, and the definition of policies. The president is at once the executive officer and the link between the faculties and the board, and enjoys a position of greater authority than the rector of a European or the vice-chancellor of an English university. Educational policies are formulated by the faculties in committee subject to the approval of the trustees.

In 1928 there were 277 junior colleges with 4,365 instructors and 55,616 students. The enrollment in 1,078 institutions giving college, graduate and professional work which reported to the United States Office of Education in 1930 was 971,584 (604,243 men and 367,341 women) taught by 71,722 professors and instructors (55,861 men and 15,861 women). The total receipts from all sources, student fees, state, local and Federal Government grants, productive funds, private and other contributions, including additions to endowment, amounted to \$567,618,169.

I. L. K.

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UNIVERSITY EXTENSION, a branch of university education provided for those unable to attend regular courses, either because of lack of admission qualifications or because of being engaged in business. The extension work may take the form of a course of lectures either at or under the auspices of a university, or correspondence courses. (See **CORRESPONDENCE SCHOOLS**.) The movement began in England, where it developed very rapidly. In America, though there had been isolated instances of lecture courses in the '30s and even correspondence courses in 1873, the movement received its impetus through the efforts of the American Library Association at its annual conference in Albany, N.Y., in 1887. Buffalo, Chicago and St. Louis were the first cities to experiment with the idea. In 1891 New York passed a bill appropriating \$10,000 for state organization of university courses, the first state on record to support such a movement. The following year the University

of Chicago added an extension division, and other universities gradually followed her example.

To-day many of the privately endowed universities and most of the state universities are carrying on extension work, the latter being supported in large part by state appropriations. The enrollment of students in extension courses in colleges and universities in 1929-30 was 195,549, more than half of these being women. For a long time extension work was of lower level than regular college work, but the standards have been gradually raised, and in many colleges credit toward a degree is given for completion of courses.

M. R.

See "Higher Education" in United States Bureau of Education, *Biennial Survey*, 1928-30, No. 16.

UNKIAR SKELESSI, a treaty between Russia and Turkey signed in 1833 by which Russia came to the assistance of Turkey, threatened by the revolt of Mehemet Ali of Egypt, whose forces had conquered all of Syria in 1832, and entered Asia Minor, successfully defeating the Sultan's generals, and threatening to push on to Constantinople. The treaty gave very large powers over the Turkish Government to Russia in return for her aid. This excited the jealousy of England, fearful of Russian influence in Turkey, and she too offered her aid to the Sultan, a policy also adopted by Austria and Prussia because under Metternich's leadership they were anxious to uphold the rights of the legitimate sovereign. France alone supported Mehemet Ali and as a consequence found herself somewhat isolated during the late thirties.

UNKNOWN SOLDIER, the name given to certain unknown men selected by various of the Allied nations, at the conclusion of the World War, to be given special honors as representing the whole. In the case of the United States, Major General Henry T. Allen, U.S.A., was directed to make the selection of the body. The one selected was one of four brought to Châlons and was the one from the cemetery of Romagne. This body was brought across the Atlantic from Havre, France, to Washington, D.C., on the historic flagship of Admiral Dewey, the U.S.S. *Olympia*. It reached Washington Nov. 9, 1921, and lay in state in the rotunda of the Capitol until the 11th, when it was escorted to Arlington Cemetery by a distinguished cortege led by President Harding, and there entombed with befitting honors.

In 1932, a sarcophagus 11 ft. high and 9 ft. wide, constructed of four blocks of Colorado marble and bearing the figures in relief of Valor, Victory and Peace, replaced the simple tomb. Thomas Hudson Jones was the sculptor and Lorimer Rich the architect.

In the years following the war, many European countries ceremoniously buried unknown soldiers as tributes to their unidentified dead. Under the stone floor of the Arc de Triomphe in Paris where an eternal flame is always kept burning is the grave of France's unknown warrior. Surrounded by a grille and a roped enclosure in the floor above, Great Britain's soldier lies at rest under the nave of Westminster Abbey. Italy's soldier is buried beneath the

altar of Victor Emmanuel Monument, Rome. Other similar memorials are found in Belgium at Brussels, Rumania at Bucharest, Czechoslovakia at Prague, Poland at Warsaw and in the Batalka Monastery in Portugal. A stone block in the city park of Budapest commemorates Hungary's unknown dead, although no one is buried beneath. The town of Dorkova has the grave of Bulgaria's unknown soldier, and a soldier of Turkey who fought in Mesopotamia and Gallipoli is buried there beneath a triumphal arch.

UNLAWFUL ASSEMBLY. See **ASSEMBLY**, **UNLAWFUL**.

UNNA, PAUL GERSON (1850-), German dermatologist, was born in Hamburg, Germany, Sept. 8, 1850, receiving his education at Heidelberg, Leipzig and Strassburg. He specialized in dermatology and is recognized as an authority on histology and histopathology of the skin, and to him is credited the placing of the study of skin diseases on a microscopic analytical basis. His contributions on skin diseases have been many and the disease which bears his name, Unna's seborrheic dermatitis, was reported by him in 1887. His monumental work is *Die Histopathologie der Hautkrankheiten*.

UNNEUTRAL SERVICE, acts of neutrals in the service of a belligerent (see **BELLIGERENCY**). According to the Declaration of London, unneutral service consists in a special voyage with a view to transport individual passengers embodied in the armed forces of the enemy, or for the transmission of enemy intelligence; and in the transporting, with the knowledge of the charterer or master, of a military detachment of the enemy, or persons who assist enemy operations. These are regarded as the lesser forms of unneutral service. The more serious offenses include a neutral vessel which takes direct part in hostilities, when she is under orders of an agent placed on board by the enemy, when she is in the exclusive employ of the belligerent government, and when engaged exclusively at the time in the transport of enemy forces or the communication of enemy intelligence.

C. E. MA.

UNTER DEN LINDEN, a prominent avenue in Berlin, extending from the Brandenburg Gate to the palace of the former Emperor William II, and thence leading to the Royal Palace by the Platz am Opernhaus, Platz am Zeughaus and the Lustgarten. It is about a mile in length and nearly 200 ft. in width, and takes its name from the double row of linden trees with which it is planted.

UNTERMAYER, LOUIS (1885-), American poet and critic, was born in New York City, Oct. 1, 1885. He received his education at the De Witt Clinton High School and at 17 entered the family firm of jewelry manufacturers. In 1923 he resigned to devote his time to study and writing. His books of poetry include *The Younger Quire*, 1910, *First Love*, 1911, *Challenge*, 1914, *Roast Leviathan*, 1923, *Collected Parodies*, 1926. In criticism he has published *American Poetry Since 1900*, 1923, and *Forms of Poetry*, 1926. He edited *Modern British Poetry*,

1920 and 1925, and *Modern American Poetry*, 1921 and 1925.

UNTERMAYER, SAMUEL (1858-), American lawyer, was born at Lynchburg, Va., Mar. 2, 1858. He attended the College of the City of New York, obtaining his law training at Columbia University, and began practice at New York City in 1879. His profound knowledge of law combined with an effective courtroom presence brought him an increasing number of important cases. In 1910 he was counsel for H. Clay Pierce in the suit to prevent domination of the Water-Pierce Co. by the Standard Oil Co. In 1912 Untermayer gained national prominence as counsel for the Pujo Committee which investigated the "money trust." A warm supporter of President Wilson, he participated in framing the Federal Reserve Bank law and other Democratic legislation. He acted as special counsel for the New York Transit Commission in 1927-30, defending the five-cent subway fare in New York City. In Jewish welfare work he became noted for vigorous and generous support.

UPAS TREE (*Antiaris toxicaria*), a large tree of the mulberry family bearing an intensely virulent milky juice used as an arrow poison. It is native to Java and other parts of the Indo-Malayan region. Extraordinary statements were formerly circulated regarding the malignant exhalations of this tree, which were said to destroy all living things within a radius of many miles. No deleterious effects, however, are observed when the tree is grown in botanical gardens and it now seems probable that the presence of sulphurous gases in volcanic valleys was responsible for the destruction of life in Java long attributed to the upas tree.

UPHAM, ALFRED HORATIO (1877-), American educator, was born in Eaton, O., Mar. 2, 1877. He was educated at Miami University, Oxford, O., at Harvard and Columbia. Upham was instructor in Latin and Greek at Miami University from 1897-1900, professor of English there from 1907-10, and from 1910-13 was associate professor of English literature at Bryn Mawr. Subsequently he returned to Miami University and served as professor of English until 1920, when he became president of the University of Idaho. In 1928 he was elected president of Miami University.

UPHOLSTERY, a method of providing a chair or bench with a resilient surface which will distribute a person's weight over a large area of his muscular structure, so reducing the discomfort of a localized pressure. The earliest method of upholstering consisted of a simple hammock, or a piece of fabric or leather stretched between supports. As the desire for comfort grew, this was probably overlaid by cushions. Later, shallow, coiled wire springs were set on the hammock, and covered. Then, as the springs were made deeper, they required "staying" or lashing together to prevent them from slipping out of place. Subsequently, two layers of shallow springs were employed, the upper set being more easily compressed for greater comfort. The double

tapered spring is a modern development in which the coils, when compressed, cannot rub together and produce unpleasant noises.

Modernly, the process of upholstering proceeds about as follows: Across the wooden base of the chair or couch is stretched a webbing of strong fabric upon which the springs are set and fastened in place and to one another to prevent any movement. Canvas is then stretched over the tops of these springs, which are slightly compressed, and is tacked to the frame work of the piece of furniture. The canvas is then covered with some resilient material, such as kapoc or horse hair, and another fabric covering applied. For still greater comfort, a final layer of wadding or hair is sometimes added, the whole being covered with calico, to which the final decorative covering is applied.

M. Sc.

UPHOLSTERY STUFFS, textiles and other materials for the covering of cushioned and padded furniture. Tooled leather, damask and needlework were the principal materials used in Europe until the 16th century, when the Italians first employed silk and velvet for upholstery. Gold-fringed red velvet is characteristic of both Italian and Spanish Renaissance furniture. In France large floral patterns, brocades and tapestries came into vogue under Louis XIV, and needlepoint, printed toiles, linen and cotton were also used. Pale tones characterize the coverings of Louis XV pieces, and Aubusson and Beauvais tapestries, imported chintz and *toile de Jouy* were important innovations. Delicately colored broche silks, satins and velvets, fixed with small gilt nailheads, distinguish the Louis XVI period. Small, spaced patterns, classical motifs, borders and stripes were in fashion under the Directoire and Empire, and fabrics were designed to fit the arms and backs of chairs.

In England upholstery stuffs were equally rich, but of a soberer and less feminine character. Under William and Mary brocaded velvets, damask and needlepoint were popular. Chintz is significant of the Queen Anne style. The patterns and materials of the Adam school (*see* ROBERT ADAM) resemble those of the Directoire and Empire; pastel silks and satins prevailed, with a similar use of stripes, spaced designs and formal motifs. American cabinet-makers borrowed designs from both France and England, using printed cottons and toiles, with patriotic emblems, also damasks and velvets, until the haircloth of the Victorian era displaced all other materials. Almost all types of period upholstery stuffs have been used by modern decorators. The modernistic school obtains new and striking effects with woolens, leather and oilcloth on both wooden and metal furniture.

UPPER CANADA COLLEGE, an institution for secondary education, at Toronto, Ont., founded in 1829. It has expanded and progressed until it has become recognized as among the best of the secondary schools in Canada. The plan of the college has been developed along the lines of the English public schools.

UPPER DARBY, a township of southeastern Pennsylvania, in Delaware Co., situated about 5 mi.

northwest of Philadelphia. It is chiefly a residential district with few local manufactures. Pop. 1920, 8,956; 1930, 46,626.

UPPER VOLTA, a colony of French West Africa, lying north of the colonies of Dahomey, the Ivory Coast and the Gold Coast and extending along the western bank of the Niger River. It covers an area of 142,820 sq. mi. and in 1929 had a population of a little over 3,039,500. This colony was established in 1919 out of territory previously a part of Upper Senegal Niger. The capital is Ouagadougou, with a population of 10,000. Other principal settlements are: Bobo-Dioulasso, population, 10,000; Ouahigouya, population, 6,000; and Dedougou, population, 3,000. Agriculture and live stock raising are the principal industries of the colony. The chief agricultural products are rice, sesame, millet, maize and cotton. Large numbers of cattle, sheep, goats and pigs are raised. The natives occupy themselves with the making of potteries, leather goods, bricks and jewelry. In 1928 the total value of the exports was 19,000,000 francs and of the imports about 10,000,000 francs. Cattle, skins, wool, cotton and gum were the chief exports, and food, textiles, and metal work the imports.

UPPINGHAM, market town of Rutland, England, 98 mi. northeast of London. It is known for the public school, which, founded about 1584 by Robert Johnson, archdeacon of Leicester, was brought to educational prominence under Edward Thring, headmaster from 1853-77. The original building still is in use. Uppingham also has the Church of SS. Peter and Paul, with Decorated tower, and a pulpit from which Jeremy Taylor preached. The town has some agricultural trade. Pop. 1931, 2,500.

UPSALA or **UPPSALA**, a town in eastern Sweden, the seat of the country's oldest and most important university, 41 miles north of Stockholm. An ancient stronghold of Paganism, Upsala became a national ecclesiastical center with the coming of Christianity, and the Swedish kings, elected nearby, were crowned here. The definitive triumph of Protestantism in Sweden was the result of the Synod held in Upsala in 1593. The cathedral is a Gothic structure, begun in the middle of the 13th century by Étienne de Bonneuil, an assistant architect of Notre Dame in Paris; its spires covered with copper are modern. Gustavus Vasa, the liberator of Sweden, is buried in one of the chapels. The University of Upsala, founded in 1477, and refounded in 1593, is in part supported from the estates bequeathed it by Gustavus Adolphus; it has a particularly fine library containing the *Codex Argenteus*, or earliest Gothic manuscript. Many books are printed in Upsala. LINNÆUS was at one time director of the Botanic Garden. Pop. 1931, 30,190.

UPSON BOARD. *See* FIBER BOARD.

URAL, a long river of eastern Russia. Rising on the eastern slopes of the southern Ural Mountains, it flows southward, turns its course west to form for some distance the boundary line between European Russia and Siberia and then flows south, emptying

into the Caspian Sea near Guriev. Although it is 1,400 mi. long, the river is useless for navigation, since the light rainfall of the region results in a dry basin and the consequent lack of large tributaries. The chief city on the Ural's banks is Orenburg.

URANIA, in Greek mythology the Muse of astronomy. (*See* MUSES.) Urania was a name also given to APHRODITE.

URANINITE, the crystallized form of PITCH-BLENDE, the uranium ORE. The color is grayish or greenish to velvet black, with a pitch-like appearance. It is essentially an oxide of uranium, with lead and thorium or zirconium, crystallizing in the ISOMETRIC SYSTEM. Small quantities are found in Colorado gold-pyrite veins, in cobalt veins of Bohemia, tin veins of Cornwall, and in pegmatites, as in North and South Carolina. *See also* SAMARSKITE; ORE DEPOSITS.

URANIUM, the heaviest known chemical element (symbol U, atomic weight 238.2), which in the pure state may be obtained as a black powder readily oxidizing in air and decomposing water, or as a shining, white, metallic substance malleable, and slightly softer than steel; specific gravity is 18.7 and it melts at a temperature around 1800°-1900° C. Its most important mineral sources are pitchblende, consisting largely of a combination of oxides U_3O_8 , and carnotite, a mixed compound of uranium, vanadium, and potassium oxides, which are found chiefly in Bohemia, the United States and the Belgian Congo. At present it is used principally in pottery and glass, which it renders fluorescent, and capable of making visible rays of ultraviolet light. Solutions of uranyl salts, such as the nitrate of the radical UO_2 , are likewise-fluorescent, while the solid salts themselves, when shaken in the dark, emit a phosphorescent glow.

It was from uranium compounds that the first indications of radioactivity were discovered, by Becquerel, in 1896. Subsequent researches have shown that uranium forms, so to speak, the primeval substance of all radioactive elements of the radium, and possibly also of the actinium series. Its own radioactivity is confined to the emission of α -rays through which process it very slowly disintegrates, losing, it is estimated, half its substance in 5,000 million years.

W. J. L.

URANIUM X_2 , a chemical element belonging to the uranium-radium series of radioactive substances, and its shortest-lived constituent. It emits β - and γ -rays, and disintegrates by half its amount in about 70 seconds for which reason it was formerly called brevium. The atomic weight is 230.5, and its chemical properties are somewhat analogous to those of TANTALUM.

URANUS, in Greek mythology the husband of GAEA and father of the TITANS, CYCLOPES, FURIES and others. He is the personification of heaven. Hating his children, he cast them into Tartarus, but CRONUS with his mother's help mutilated his father and took the throne. From the blood which flowed from Uranus's wound and mingled with the foam of the sea Aphrodite is said to have sprung.

URANUS, the seventh planet in order of distance from the sun, was discovered in 1781 by William Herschel. It revolves around the sun in 84 years at an average distance of 1782 million miles. Uranus is just visible to the unaided eye, appearing as a star of the sixth magnitude. Its diameter is about 32,000 miles, four times greater than that of the earth. In volume it surpasses the earth 64 times, in mass 15 times; its density is only 1.27 times that of water. It rotates on its axis in about 11 hours. Uranus has four satellites, revolving in periods from $2\frac{1}{2}$ to $13\frac{1}{2}$ days, at distances ranging from 119,000 to 364,000 miles. They are all small bodies, probably from a few hundred to a thousand miles in diameter.

URBAN, name of eight popes: St. Urban I, was Pope, 222-230. Blessed Urban II, 1088-99, carried on the policy of Gregory VII, excommunicated rulers and organized the First Crusade. Urban III, 1185-87, was a bitter opponent of Frederick I Barbarossa, who imprisoned him. Urban IV, 1261-64, one of the outstanding medieval popes, instituted the Feast of Corpus Christi, 1264. Blessed Urban V, 1362-70, an enemy of nepotism and friend of scholarship and justice, resided in Rome after 1367, but returned to Avignon in 1370. Urban VI, 1378-89, was so severe to the cardinals that they deposed him, though he was recognized by the leading powers. Driven from Rome, he had five cardinals executed at Genoa for treason. Urban VII was Pope Sept. 15-27, 1590. Urban VIII, 1623-29 and July 1644, supported Richelieu in the war against Austria and Spain for fear of the power of the House of Hapsburg, and was indifferent to the Protestants and Sweden's interference in Germany. His pontificate embraced most of the Thirty Years' War.

URBAN or MUNICIPAL COLLEGES AND UNIVERSITIES, institutions of higher education supported by municipal taxes. Such colleges are open, without tuition fees, to students residing in the city who are able to meet their entrance requirements. The first municipal university in the United States was established in Charleston, S.C., in 1837. The same year the University of Louisville, Ky., was established and 10 years later the College of the City of New York. The growth of this type of college has been very slow, but there are indications that it will be much more rapid in the future. In 1932 there were only ten municipal colleges in all. In addition to those named are Hunter College of the City of New York, 1870; University of the City of Cincinnati, 1871; University of Toledo, 1884; University of Akron, 1913; University of Detroit, 1923; Municipal University of Wichita, Kan., 1926, and Municipal University of Omaha, 1931, which was formerly the University of Omaha. Ohio, which has been the leader of this movement, passed an act in 1910 which provides for any city in the state establishing a municipal university and supporting it by municipal taxation. Some of the municipal colleges have been established by city ordinances or special legislative acts.

URBANA, a city of eastern Illinois and county seat of Champaign Co., 128 mi. south of Chicago. It is, in effect, one municipality with the city of CHAMPAIGN on the west, sharing its railroad facilities and the campus of the University of Illinois, established in 1867. The city is located in a productive grain district. Repair shops of the Big Four Railroad are in Urbana. In 1929 the value of the factory output was about \$1,000,000; the retail trade amounted approximately to \$6,090,000. Crystal Lake Park is a fine example of landscape architecture. Urbana was incorporated in 1855. Pop. 1920, 10,244; 1930, 13,060.

URBANA, a city in western Ohio, the county seat of Champaign Co., situated 14 mi. north of Springfield. It is served by bus lines and three railroads. Grain is raised in this region. The city is an industrial center, manufacturing furniture, tools, dies, paper-board, paper and brooms. Dairy products are a leading interest. Located here is the Urbana Junior College. William Hull's march to Detroit started from Urbana, in 1812. Near by are Mac-o-chee Castle and the Ohio and Zane caverns. Urbana was founded in 1805; chartered in 1867. Pop. 1920, 7,621; 1930, 7,742.

URBINO, a town of east central Italy, situated in the Marches, about 20 mi. southeast of San Marino. The ancient Roman *Urvinum Metaurense*, Urbino was a courtly and artistic center under the dukes of Montefeltro, Federigo (1444-82) and Guidobaldo (1482-1508). The house in which RAPHAEL was born is now a museum. Especially noteworthy are the Ducal Palace, erected in 1465, and the cathedral, completed in 1801. Pop. 1931, 20,371.

UREA or **CARBAMIDE**, a white crystalline substance containing 46.6% nitrogen, 20% carbon, 6.67% hydrogen and 26.7% oxygen having the formula $(\text{NH}_2)_2\text{CO}$. Urea is very soluble in water or alcohol and crystallizes in rhombic needles. The melting point is 132°C . and when strongly heated urea decomposes into ammonia, biuret $(\text{NH}_2\text{CONHCONH}_2)$ and other products.

Long known as a constituent of urine, being the final product of decomposition of proteins in the body, urea was first produced artificially by F. Wohler in 1828 by heating together potassium cyanate and ammonium sulphate. Modern commercial methods of preparation are: (1) acid hydrolysis of cyanamide made from calcium carbide and (2) heating of ammonium carbamate, formed from ammonia and carbon dioxide, between 135° to 150°C . and at pressures of 35 to 50 atmospheres. Since 1920 technical improvements in the commercial production of urea have been numerous and daily production in excess of 125 tons has been accomplished.

Because of its high NITROGEN content and ready solubility urea finds considerable use in FERTILIZERS. Mixtures with phosphate materials are especially suitable for some purposes, e.g., tobacco growing. In more strictly chemical industries urea is used as a stabilizer in EXPLOSIVES, as a constituent of airplane "dopes" and its derivatives are widely used in the

manufacture of DYES. Urea has long been used as one of the substances in the synthesis of important drugs. Veronal, bromural, proponal, ursal and urea-bromin are among the better known. (See SOPORIFICS.) In general, urea functions as an antipyretic and diuretic, but is little used. Its quantitative presence in both urine and blood, however, are of diagnostic value. N. W. K.

UREMIA, a disorder resulting from kidney insufficiency. It may occur in any form of kidney inflammation, complicating acute or chronic nephritis, in tuberculosis of the kidneys or stones in the kidneys. See CALCULI.

The exact origin of uremia is not known. There are several theories: first, the accumulation of substances in the blood that are normally excreted by the kidneys; secondly, the production of abnormal toxic substances resulting from defective kidney action; and third, localized edema of the brain. There are objections to all these theories, but the second seems the most probable, though there is no definite evidence to support it.

In uremia, there are three principal groups of symptoms: cerebral, gastro-intestinal and dyspneic. In some cases one set of symptoms predominates and at other times another set is more important.

In the cerebral group, COMA or unconsciousness is most common. Coma usually terminates the other forms as well. The unconsciousness is often preceded by headache, drowsiness or delirium, by vomiting, twitching of the muscles and cramps in the legs. Other symptoms are CONVULSIONS, acute mania and delusions.

The gastro-intestinal symptoms are vomiting, nausea and hiccough. Later, there occur shortness of breath and coma.

In the dyspneic group, there is shortness of breath or dyspnea. The breathing is hissy and noisy, or may be of the type known as Cheyne-Stokes, in which periods of rapid breathing alternate with periods of slow deep breathing.

In the early stages of uremia, then, there are headache, sleeplessness, nausea, vomiting, tingling of fingers and muscle cramps. As the disorder progresses vomiting becomes more severe, attacks of dyspnea occur, and various paralyses may result. In the late stages there are convulsions, with death in coma.

Chronic uremia is the term applied to the persistent presence of the milder symptoms, such as headache, vomiting, restlessness and insomnia. Wasting, dryness of the skin and a sallow complexion are usually present. The disorder concludes through some terminal infection, such as pleurisy, in acute uremia, or through temporary improvement.

The diagnosis is made through tests to determine the efficiency of the kidney function. The outlook is always serious. Recovery is more frequent when the uremia occurs in acute nephritis than in any other form. When occurring in chronic nephritis, recovery is rare. The treatment is similar to that used for chronic nephritis. Sweating is induced, opiates are

given to control restlessness and shortness of breath. Venesection and blood transfusions are employed.

W. I. F.

URETERS: Anatomy of. See URINARY SYSTEM.
Calculi in. See CALCULI; UROLOGY.

URETHANS, esters of carbamic acid. The term is most commonly used for ethyl urethan, $\text{NH}_2\text{COOC}_2\text{H}_5$, which is a mild sedative and sleep-producer, but has been largely supplanted by the BARBITURIC ACIDS and other hypnotics. Urethan is prepared by the reaction of ethyl-chlorocarbonate and ammonia.

E. H. V.

URETHRA. See URINARY SYSTEM.

Polyp of. See POLYPUS.

URFA, a city of Asiatic Turkey, situated about 80 mi. southwest of Diarbekr, on the site of ancient EDESSA. Urfa, inclosed by battlemented walls, contains a large mosque which is supposed to occupy the site of a Christian church and an ancient citadel noted for its Corinthian columns. In the 11th century the Crusaders made Urfa a Christian principality, which the Mussulmans destroyed in 1144. Urfa, although it is on the route between Aleppo and Mosul, has few commercial activities. The rich surrounding region produces wheat. Est. pop. 1927, 45,000.

URGA (Chinese *Hurea*), the capital city of the Mongolian Soviet Republic, situated on the ancient caravan route through Outer Mongolia to Turkestan and Russia. For many centuries it has been the holy city of the Mongols, and formerly was the seat of the Hutuktu, "The Living Buddha" of the Mongolian tribes. Since the last living Buddha died in 1924 no one has taken his place. It was formerly the center of Chinese trade with Outer Mongolia, but since the declaration of independence by the Mongols and the establishment of the Soviet Republic under Russian domination in 1924, practically all Chinese trade with the city has stopped. Pop. 1929, about 40,000 including some 13,000 monks.

URIAH HEEP, a villainous hypocrite in Dickens's *David Copperfield*. In all relationships he conceals his malign purposes under an appearance of extreme humility. Uriah's mother, Mrs. Heep, is also a skilled practitioner in the art of being "humble."

URIC ACID, an organic compound which in some animals, notably man, is the end product of the metabolism of the purin of components of the food. In chemical composition ($\text{C}_5\text{H}_4\text{N}_4\text{O}_3$), it has the configuration representative of the purins. It is the most highly oxidized member of the group. The proteins of the cell nucleus are rich in the purins adenine and guanine, which are aminopurins. Muscle contains hypoxanthin and xanthin, which are lower oxypurins than uric acid. All of these compounds are excreted largely in the form of uric acid in man. In most animals, and to a certain extent in man, these are oxidized to carbon dioxide and ammonia. Some persons have difficulty in excreting uric acid. As a result GOUT is produced. See also GOUT; RHEUMATISM.

URIM and **THUMMIM**, Biblical terms denoting objects connected with the breastplate of the high

priest and presumably serving in some obscure fashion the purpose of divination or the casting of lots. The literal meaning of these Hebrew words appears to be *light* and *perfection*; yet these meanings are disputed. Some authorities contend that the words are opposite in meaning, *urim* having the unfavorable and *thummin* the favorable significance. In this sense the objects would be used to determine the guilt or innocence of accused persons, as in I Samuel 14:41. What is clear, however, is that in all probability the custom of using the *urim* and *thummin* fell into disuse after the time of David and Solomon, for no direct mention of their use is found in the later books of the Bible.

URINARY SYSTEM, that system of the body which filters out the soluble waste matter from the blood through the kidneys, carries it by way of the ureters to a reservoir—the bladder, thence discharges it through the urethra.

The excreting portion lies entirely within the *kidneys*. It is made up of the nephrons, which are little tubes, each 2 inches long and varying in thickness in different parts from 1/1200 inch to 1/200 inch. There are about 2,400,000 in the two human kidneys. They are surrounded by blood capillaries, from which they take waste substances in solution. One end of each nephron is connected with the end of a discharge tube and it gives up to that tube its excreted solution as urine. Each nephron has four parts: (1) the ball (glomerulus), (2) the first convoluted part, (3) the loop, and (4) the second convoluted part.

The glomerulus is a hollow ball or capsule, with one side entirely indented and filled with a tuft of blood capillaries. It excretes the more fluid parts of the urine into the first convoluted tubule. This latter is lined with a layer of cylindrical cells of characteristic appearance which are very active excretory agents. They excrete more concentrated solutions or even colloid suspensions. Some vertebrates have no glomeruli and in them the first convoluted tubule does all the excretion. The loop is long and thin, being only 1/1200 inch in diameter. It probably provides resistance, so that fluid will not pass too rapidly along the nephron. Some think it re-absorbs some water and salt solution.

The second convoluted tubule probably corrects the mistakes of the first three parts. It re-absorbs water and useful solutions and delivers waste and useless solutions in fairly constant dilution to the discharge tubes. It connects with the end of a tiny discharge tube. Nephrons and discharge tubes develop separately. Each nephron grows onto a discharge tube about the 3rd intra-uterine month. The discharge pipes are partly in the kidney (collecting tubes), partly at the hilus of the kidney (pelvis of kidney), partly below the kidney (ureters, urinary bladder, and urethra).

The collecting tubes within the kidney are arranged in about 15 groups in each kidney. Each group is like a shrub with approximately 17 hollow stalks branch-

ing into twigs to the ends of which nephrons are attached like leaves on a bush. Each bush makes one lobe of a kidney and it has about 80,000 twigs with nephrons attached. Arteries run between the lobes and give branches to each nephron, but there is little interlobular connective tissue. The lobes intermingle somewhat at their margins. Nevertheless each is distinct, like the separate bushes in a clump. All the 17 stalks or large collecting tubules of one bush (one lobe of the kidney) open close together on a kidney papilla and pour their urine into one of the collecting cups (calyces) of the renal pelvis.

From each renal pelvis a tube or *ureter* leads to the urinary bladder. Each ureter is $\frac{1}{5}$ inch in diameter, 1 foot long and at its lower end runs for an inch obliquely through the bladder wall before opening into it. This obliquity has a valve-like action, shutting off back flow from the bladder when it is distended.

The *bladder* has a capacity of about $1\frac{1}{2}$ pints when distended. It acts as a storage reservoir. Its walls are of smooth muscle and elastic connective tissue—the elasticity being most evident in its upper part (*see also* BLADDER, URINARY). It discharges below and in front, into the single, median *urethra*, $1\frac{1}{4}$ inches long in the female and 8 inches long in the male. Around the upper end of the urethra is a ring valve (sphincter) of smooth muscle, continuous with that of the bladder but under special automatic nervous control. Another sphincter muscle a little lower down is under control of the will. It lies within the urogenital diaphragm in the angle of the pelvis, and it holds this part of the urethra in place.

The *prostate gland* in the male surrounds the urethra between the two sphincter muscles. Through it the two ejaculatory seminal ducts run to empty into the urethra. In the female, the small *paraurethral glands* are the tiny homologue of the prostate.

The *urine* is a fairly concentrated solution, and from it dissolved substances often crystallize out. Small “stones” may be formed in this way in the renal pelvis. They pass down the ureter usually without trouble. But large ones may cause excruciating pain during their passage. They are more common and larger in the urinary bladder (*see* CALCULI). *See also* UROLOGY. B. C. H. H.

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URINE. *See* EXCRETION; URINARY SYSTEM; *see also* DIURETICS.

UROLOGY, the study of that group of organs, constituting the urinary tract, the function of which is to eliminate from the body the waste fluid known as urine. Urology determines the nature of disturbances in these organs and devises ways of remedying them. Previous to this century, we had no means of knowing the nature or location of these diseases, except through urinalysis, which merely told us that there were certain evidences of disease somewhere. The early years of this century, however, produced two epoch-making innovations which have changed all

this. By means of the cystoscope, we can look into the bladder, photograph it if we will, and extend our investigations into the kidneys themselves; and much of what we cannot see directly with the eye, such as stones, is revealed to us by the X-ray, so that we are rarely left in doubt as to the condition we have to deal with.

Pathologic conditions in the urinary tract constitute a serious menace to life. The most important of these will be mentioned briefly:

Infection. At least 75 different varieties of bacteria have been identified as infecting agents in the urinary tract. Infection follows when bacteria enter the kidney by way of the blood stream from an infectious focus in some other part of the body, such as the teeth, tonsils, lungs and other infected organs. Infection may also descend from the bladder, without entering the blood-stream.

The most common kidney infection is *pyelitis*, which involves the pelvis or vestibule of the kidney proper. It is frequently met with in children as a sequence of measles and scarlatina; it is also quite common in pregnancy. Pyelitis is generally caused by bacteria of the colon bacillus type which have their natural origin in the intestines. This condition is quite easily recognized and usually curable without permanent damage.

The more serious kidney infections are those which produce pus accumulations (*abscesses*) in the kidney substance, often to the extent of destroying the organ, partly or completely. So long, however, as one kidney functions normally, the general bodily health is satisfactorily maintained, but if both kidneys are involved, the menace to life is directly proportionate to the diminution in kidney function.

Perhaps the most important kidney infection is *tuberculosis*. This disease occurs most frequently in young adults and eventually extends to the lower urogenital organs. Careful examination often reveals a tuberculous focus in the lungs from which the infection has probably spread to the urinary tract. Only one kidney is usually involved, both rarely. Kidney tuberculosis is generally chronic from the outset and may be symptomless for long periods, but when the bladder has been attacked the symptoms are extremely severe—and debilitating.

Stone. Stone (calculus) is the next most common urologic condition and is generally associated with infection and tissue destruction. Stone usually originates in the kidney and may remain quiescent for years. The entire kidney substance may be destroyed through the encroachment of one large stone or many small ones. A kidney full of stones may give no symptoms whatever, whereas one small stone may be the cause of the most excruciating attacks of pain (renal colic). A small smooth stone may leave the kidney, pass down the ureter and into the bladder and then may be voided with the urine—all with very little or no discomfort. It is only when the stone becomes impacted somewhere along its route that attacks of colic occur and back pressure on the kidney arises with in-

jury to its functioning power. In the bladder, the stone may grow to enormous proportions, causing considerable pain and serious impairment of bladder function. The presence of blood in the urine may be the only symptom. (See also CALCULI.)

Tumors. Tumors are quite common in the urinary tract. In the bladder they may make their appearance as benign growths (non-cancerous), but eventually take on all the characteristics of true malignancy. The favorite location is the floor of the bladder. Their presence is associated with pain, blood in the urine, and disturbance in the urinary function. Tumors of the kidney are generally malignant from the beginning. (See also TUMORS.)

Diagnosis. The cystoscope and the X-ray combine to make the diagnosis almost a certainty. Cystoscopy in expert, gentle hands, with the aid of a local anesthetic, is an almost painless process, except in very rare cases. By its aid we examine the interior of the bladder and determine the presence or absence of inflammation, stone or tumor, their number, size, character and location. We can cut off a small bit of tumor for microscopic examination.

We next insert a fine, long catheter into each of the ureters, which reaches the kidney pelvis unless obstructed by stones, kinks or other obstruction. A chemical dye substance, injected into a vein in the arm passes through the kidney and appears in the ureteral catheter in four or five minutes, in the normal case. When kidney function is impaired, appearance of the dye is delayed. In this way we can tell whether or not the kidneys are functioning normally, and if not, to what degree they are impaired.

To complete the examination, we inject through the catheters a solution which enters the kidney and is then revealed in detail on the X-ray plate. We now have a very clear idea of the nature of the ailment, its location and extent, and we further know how much damage, if any, has been done to each of the kidneys. In certain cases in which cystoscopy cannot or should not be done, especially in children, we get very valuable diagnostic information through the aid of a very recent innovation. Iodine solution injected into a vein of the arm appears in the urinary tract within a few minutes. X-ray pictures are then made, which reveal the presence of abnormal conditions in the entire tract with considerable accuracy.

Treatment. Treatment of these various conditions varies with the particular lesion. Infections (especially pyelitis) are successfully treated by the use of internal medication (antiseptics) combined generally with certain surgical measures which aim to remove the offending cause. In many infections of the kidney, particularly tuberculosis, the diseased organ is removed entirely after determining that the other kidney is sufficiently sound to function normally. One can live better and longer with one good kidney than with two that are defective. Stones which are impacted must be removed by surgical operation. Small stones are often removed from the bladder through the cystoscope. Large stones may be crushed

and the fragments removed from the bladder by suction. Tumors of the bladder in the pre-malignant stage can be destroyed by electricity through the cystoscope. In the malignant stage, radium is often effective, but it generally must be combined with radical surgical procedures. See also BLADDER, URINARY; CHILDREN, DISEASES OF: Prenatal Diseases; KIDNEY, DISEASES OF; URINARY SYSTEM. A. L. Wo.

URQUHART, SIR THOMAS (1611-60), Scottish translator, was born in Scotland, probably at Cromarty, in 1611. He was educated at King's College, Aberdeen. Later he traveled in Europe, speaking French, Spanish and Italian with such perfection that he passed as a native of all three countries. In 1641 he was knighted by Charles I. Taken prisoner at the Battle of Worcester, he was sent to the Tower of London in 1651, but was released by Cromwell. In 1653 Urquhart's translation of the first two books of FRANÇOIS RABELAIS was published. It is conceded to be one of the finest translations of any author ever made. Urquhart gives an exact rendering of the style of Rabelais, matching idioms, slang and personal twists with an unrivaled perfection. The translation was completed by PIERRE ANTOINE MORTEUX. Urquhart is commonly supposed to have died abroad in 1660.

URQUIZA, JUSTO JOSÉ (1800-1870), Argentinian statesman and general. At the beginning of his career he was a staunch supporter of Rosas, the Argentinian dictator, but in 1851 he turned against Rosas and used his position as governor of Entre Rios to form an alliance with Brazil and Uruguay. The alliance defeated Rosas and a convention was called to adopt a constitution, but Buenos Aires remained outside the federal state of Argentina. Urquiza became the first president of the confederation and his term of office, 1853-1859, was marked by decided progress. He signed numerous commercial treaties, encouraged immigration, subsidized state education, and built railroads. In 1859 he brought Buenos Aires into the confederation. When war broke out between the confederation and Buenos Aires in 1861, he led the forces of the former, but retired before the end of the conflict. He was a candidate for the Presidency in 1868, but was defeated by Sarmiento and retired to Entre Rios where he was assassinated, Apr. 11, 1870.

URSA MAJOR (gen. *Ursae Majoris*), the Big Dipper, also called the Great Bear, is the best known constellation in the sky, and one of the very oldest. Charles's Wain, the Seven Oxen, David's Chariot and the Hippopotamus are some of the names under which it has been known throughout the centuries. Its seven principal stars are arranged in the familiar form of the dipper and need no further description.

Of these seven stars, six are of the second magnitude, and one of the third. The five middle ones are white. All are at about the same distance of 70 light years and surpass the sun from 15 to 90 times in luminosity. They are physically connected and move together through space, forming the Ursa Major

Cluster. The middle star of the handle, *MIZAR*, or *Zeta Ursae Majoris*, and its faint companion *ALCOR* are of especial interest since they constitute a closely connected group of at least five stars. The end star of the handle, *Eta Ursae Majoris*, is blue, about 80 light years distant and 100 times brighter than the sun. The star at the other end of the bowl, *Alpha Ursae Majoris*, is yellow, about 55 light years distant and 40 times brighter than the sun. Neither of these belongs to the *Ursa Major* Cluster. The last two stars of the bowl, *Alpha* and *Beta Ursae Majoris*, are often called the pointers for the reason that if a line is drawn through them and extended northward by five times its own length, it passes close to the Pole Star.

Ursa Major is a large constellation and contains, besides the seven stars just mentioned, numerous other stars of the third and fourth magnitude. Among them is the fourth magnitude star *Xi Ursae Majoris*, a quadruple star 23 light years distant. The four components are all about 3 to 6 times fainter than the sun, and are arranged in two pairs revolving about each other in 60 years at an average distance of 160 million miles. See *STAR: map*. W. J. L.

URSA MINOR (gen. *Ursae Minoris*), the Little Bear, or Little Dipper, the constellation at the north pole of the heavens, containing *POLARIS*, the Pole Star, as its brightest star. The alignment of its seven principal stars is so familiar as to make description superfluous. *Beta Ursae Minoris* is next to *Polaris* in brightness, is yellow in color, some 80 light years distant and about 100 times brighter than the sun. See *STAR: map*.

URSULA, ST. (5th century), legendary princess and Christian martyr, was born, according to the legend, in the south of England at some time during the 5th century. When the Saxons invaded England the Britons fled, some to Brittany or Bretagne, and some to Rhineland near the mouth of the Rhine. According to the story, Ursula, a chieftain's daughter, was the leader of a band of Christians numbering many thousands, all of whom were slaughtered by the heathen Huns near Cologne. A famous church in Cologne contains a vast collection of bones which, it is alleged, are the remains of these martyrs. The medieval belief was that all these martyrs were young girls. A modern non-Catholic theory is that the legend of St. Ursula is a Christianized version of an old Teutonic legend of a goddess, with a name somewhat similar to that of Ursula, who welcomed the souls of departed maidens. This version of the story is found in old Thuringian and Swedish mythology. The feast of St. Ursula is celebrated on Oct. 21. In course of time a voluminous literature has grown up in connection with the historicity of Ursula.

URSULINES, the oldest female religious order instituted in the Catholic Church for educational work. It dates from 1535 when St. Angela Merici established her "Company of St. Ursula" in community at Brescia, Italy. The order had already spread to France and Germany when in 1544 its members embraced the Augustinian Rule, with papal

approval. The oldest house in the United States is at New Orleans, La., this order being founded in 1727. In America the Ursulines have undertaken the education of Indians with particular success; they also have Eskimo missions in Alaska. The Roman Union of Ursulines, formed in 1900, now includes about 180 communities with approximately 3,700 religious in most European countries, the British Isles, North and South America and elsewhere. An independent branch, the Ursulines of Quebec, conducts there one of the oldest institutions of learning for women in North America.

URTICARIA, or **HIVES**, seems to be a reaction of the skin to some substance that is eaten to which the individual is abnormally sensitive. It is not always possible, however, to establish a direct relationship between the disorder and the offending food. Strawberries, shellfish and eggs seem to be the most common foods producing hives.

The rash consists of white, pink or red swellings accompanied by itching or stinging sensations. The swellings vary greatly in size and shape. The lower trunk, the buttocks and outer surfaces of the thighs are most frequently involved. In ordinary cases, the rash persists for from several minutes to several hours and disappears spontaneously, leaving no trace. Scratching and rubbing make the rash worse. The condition may be acute or chronic. The acute form is more common. Over a period of three or four days, crops of new blisters appear as the old ones disappear. In the chronic variety there are repeated attacks of the acute type, or there may be small, persistent swellings.

If the cause for the urticaria is discovered, treatment consists in its elimination. When the cause is unknown, the intestinal tract is thoroughly emptied, the diet restricted to a few simple foods, and local preparations such as calamine lotion are applied to relieve the itching. See also *ALLERGY*. W. I. F.

URUGUAY, the smallest of the South American republics, situated south of Brazil between the 30° and 35° S. lat. and 52° and 58° W. long. It is bounded on the east by the Atlantic, and on the south and west by the rivers Plata and Uruguay, which divide it from Argentina. Area 72,150 sq. mi. Est. pop. 1930, 1,903,083.

For the most part Uruguay is a rolling, grassy plain with almost no wastelands, few forests and no mountains. It is an excellent grazing country. The region constitutes a border zone between temperate and tropical climes; nowhere do freezing temperatures arrest for long periods the growth of grasses. Mean summer temperatures range from 72° to 80° F., in the northwestern part of the country summer temperatures may reach 106° F. The distribution of an annual total generally between 35 and 60 in. of rain possesses favorable uniformity, although the number of rainy days is small.

Trees such as the willow and poplar, the *inga*, a hardy and leafy mimosa, besides the *tacuara*, a bamboo of vigorous habit, fringe the river banks. Else-

where predominate grasses which have favored grazing; on the ridges these include bunch types belonging to several genera, as *Stipa*, *Aristida*, *Andropogon* and *Panicum*; in the swales of the undulating prairie a continuous turf of fine grasses and herbs prevail. The Australian eucalyptus was introduced in recent years and has been successful on both sides of the Plate estuary.

Rather than take to laborious tasks on the farm, the sparse population, 18 persons to the sq. mi., exclusive of Montevideo, harbors a traditional preference for a free and open life on the cattle and sheep ranges. Only in the southern coastal departments are there cultivated crops; wheat, linseed, corn and oats have displaced livestock on these fertile alluvial soils.

Through a development in recent years the production of meats for export has become the major industry of Uruguay. The country owned over 9,000,000 head of cattle in 1930. There is an annual export of about 350,000,000 lbs. of beef to foreign markets; this is about 12% of total world exports.

Wool supplies almost one-third of the value of Uruguayan exports. So profitable does wool prove, that despite the grazing of about 19,500,000 head in 1929, sheep furnish relatively little mutton, either for domestic or foreign consumption. The breeding of the Rambouillet and merino strains is important.

Uruguay is handicapped for significant manufacturing developments. It has practically no coal, petroleum or minerals for a basic iron and steel industry; it possesses meager forest reserves, little water power and few raw materials for large factory establishments. The principal industries consist of meat packing, and textile, cement, glass, brick and furniture manufacturing.

Uruguay has a purer European population than any other South American country. Owing to their intractability, the scattered groups of native Indians suffered virtual extermination. Hence the present day population comprises 90% dominantly white, 8% mestizo and 2% Indian and Negro. MONTEVIDEO, the capital, has more than one-quarter of the national population.

HISTORY

Originally known as the Banda Oriental (eastern shore of the Rio de la Plata), late and sparsely settled, Uruguay constituted a part of the Spanish viceroyalty of Buenos Aires. It participated in the revolt of Buenos Aires against Spain, and in 1814 the patriots captured Montevideo. Schism in their ranks enabled the Portuguese in Brazil, who had always disputed possession of the region, to invade it in 1816. It was formally incorporated into Brazil in 1821, but four years later the Uruguayans revolted and sought annexation to the Argentine Confederation. The war which ensued was ended by the friendly mediation of Great Britain in 1828. Uruguay was set up as a separate republic, its independence guaranteed by Argentina and Brazil.

Fructuoso Rivera became the first President in July 1830, and his successor, Manuel Oribe, took office in Mar. 1835. The two men soon came into open warfare, Rivera heading the Colorados and Oribe the Blancos, party names which have persisted down to the present time. The dictator Rosas of Buenos Aires seized the occasion to interfere by sending troops to support the Uruguayan President, and when the latter was forced out in 1838 gave him asylum across the river. From 1843-51 Montevideo was intermittently besieged by Rosas and the Blancos, and the injury to European trade led to open war by England and France against Rosas, to his ultimate undoing.

Factional strife continued, inviting Brazilian intervention, and from 1865-70 Uruguay was involved with Brazil and Argentina in the War of the Triple Alliance against Paraguay. After 1865 the Colorados were continuously in power, a situation which made for domestic turbulence and arbitrary government. In the decade 1876-86 the country twice suffered a military dictatorship; it shared in the spectacular boom of Argentina in the late 80's, and in the financial crash of 1891.

The assassination of President Borda during a Blanco revolt in 1897 brought into power Juan L. Cuestas, the first to make consistent efforts at reform in finance and administration and in the elimination of military influence. His work was continued by José Batlle y Ordóñez, President in 1903-07 and in 1911-15. The last serious insurrection was in 1904. Batlle, leader of the Colorado party, was an able and resolute personality, under whom Uruguay entered upon her modern era of stability and progress. Political persecution ceased, the press was made free, and the country entered upon an advanced social program, including Government ownership of utilities and key industries and legislation for the protection of the laboring classes. Old-age pensions, an eight-hour day, and industrial education were provided for, and harbor and other public works were constructed. A constituent assembly in 1917 introduced the secret ballot, minority representation, and greater local self-government. It disestablished the Church, and provided for a plural national executive, in which authority is divided between a President and a National Council of Administration of nine members, all chosen by direct popular vote.

In 1917 the Uruguayan Government severed diplomatic relations with Germany, and expressed its "sympathy and moral solidarity" with the United States, but did not actually make war. The national debt is large in proportion to the population, and military expenditures are high, in this small state wedged between two powerful neighbors; but to-day Uruguay is one of the most progressive and stable of the Latin-American republics.

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URUGUAYAN LITERATURE, the literature of the Republic of Uruguay, South America, which is

treated under the heading, LATIN-AMERICAN LITERATURE.

URUMIAH, a lake of Persia in the province of Azerbaijan, 4,500 ft. above sea level. It is 90 mi. long by 25 broad and contains numerous islands, lies in a former marine basin about 20,000 sq. mi. in extent, and itself has an area of 1,795 sq. mi. The lake is very shallow, with a mean depth of 20 ft.; and its water is highly saline, and hence is destitute of fish. Its only fauna is an *Artemia*, a species of crustacean formerly supposed to be a jellyfish. The lake is fed from the east by the Aji-chai, rising at Mt. Savalan, and by the Jaghatuchai and other smaller streams from the south and west. Lake Urumiah is also known by the names Urmia, Urumia, Urumiyah and Urmi, and is known locally as Urmi, from the town of Urmi on its west side, which for many years was the center of a flourishing American mission.

USKUB, or, locally, Skoplje, a city of Macedonia, YUGOSLAVIA, capital of the Vardar *banovine*, the main stop on the Nish-Salonika railway, and situated in a plain on the banks of the Vardar River. An old Turkish palace, the residence of the former Turkish governors of the Skoplje vilayet, a Roman aqueduct, and a few churches and mosques are the chief architectural features. The distributing center for the products of the province, rich in opium, maize, oats and barley, Skoplje also is engaged extensively in silk-worm culture. Among its manufactures are leather, soap, braid, sugar and horseshoes.

Skoplje has been growing at the expense of Monastir which was, next to Salonika, the largest and most important city of Macedonia until the Balkan War of 1912. A prominent military post in Turkish days, the city is to-day the base of one of Yugoslavia's five army provinces. It has been the scene of considerable revolutionary activity on the part of the Macedonians.

Known as Scupi, in the 13th century after Skoplje was captured from the Byzantines by King Milutin, it became the capital of Serbia. Later the Turks captured the city and held it until it was occupied by the Serbian army in 1912. Pop. 1931, 64,807.

USKUDAR or **SCUTARI**, a city of Asiatic Turkey, picturesquely situated on the Bosphorus across from Constantinople, of which it is a suburb. Tiers of painted wooden houses stand on the incline above the water, and with the minarets of numerous mosques and clusters of cypresses in the background, present one of the most striking views on the Bosphorus. Uskudar is particularly noted for its cemetery, the largest and most beautiful in the environs of Constantinople. The Valideh mosque, built in 1547, is the most important place of worship. Before the days of the railway Uskudar was the western terminus of the caravan routes to Syria and Asia, and the post station of the Asiatic couriers. In fact the name of the city is derived from the Turkish word meaning courier, *Uskudar*. Among the products manufactured are silk, muslin and cotton stuffs. Pop. 1927, 155,092.

USSHER or **USHER, JAMES** (1581-1656), Irish prelate and theologian, was born at Dublin, Jan. 4, 1581. He was educated at Trinity College, Dublin, and was made professor of divinity there in 1607. In 1624 Ussher became archbishop of Armagh and primate of Ireland. At the outbreak of the Civil War, he took the royalist side, and nearly all his property was confiscated. He went to England and served as preacher to the Society of Lincoln's Inn, London. He was the author of a work attempting to fix the chronology of the Bible, *Annals of the Old and New Testament*, 1650-54. Ussher died at Reigate, Surrey, Mar. 20, 1656, and was buried in Westminster Abbey.

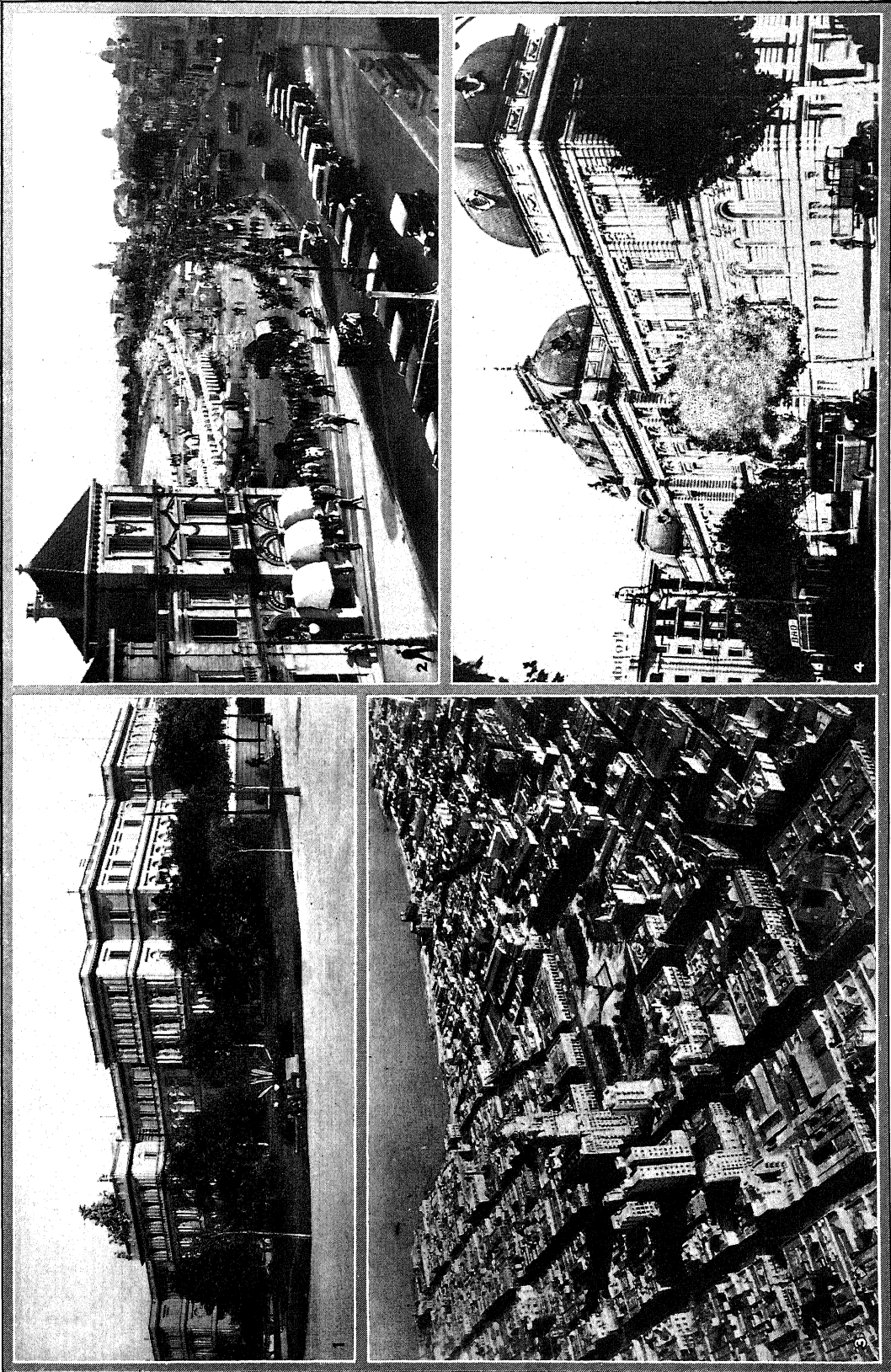
U. S. S. R. (Union of Socialist Soviet Republics), the name given to a united state of Europe and Asia formed on the territory of the former Russian Empire. See RUSSIA; UNION OF SOCIALIST SOVIET REPUBLICS.

USTI NAD LABEM (German *Aussig*), a city of Czechoslovakia, a busy port and shipping center in North Bohemia and on the Labe (Elbe) River, also an important railroad center. It has a city hall and a church with a fine Madonna statue. Usti is important for its large trade and industry, including a chemical factory, and the manufactures of textiles, machine glass, earthenware, sugar and other products. The volume of trade by water is large, particularly in lignite and sugar. In 1282 Usti was a royal city, but it changed hands several times and was captured and partly burned by the Hussites in 1426. In 1538 it was burned and in 1639 captured by the Swedes. After the downfall of the dual monarchy, there were repeated riots and plundering on the part of the Czechs in 1918, 1919 and 1921. Nearly all the inhabitants are Germans. Pop. 1921, 39,830; 1930, 43,802; of these about 6,885 were Czechs.

USURY, generally an excessive charge made for a LOAN. Formerly no distinction was made between INTEREST and usury. In Roman law interest (*interesse*) could be charged a defaulting debtor to the amount of the damage suffered by the creditor. From this idea of compensation came the term *usura*. An evil significance attached to this term, because despite laws limiting interest, money lenders charged exorbitant rates. Very high interest was charged also in Greece and on occasion at least among the Hebrews. It was everywhere reprobated, partly because most loans were contracted for consumption purposes or by people in financial difficulties. Opposition to usury came into church doctrine and canon law through the influence of Aristotle's argument against it. The gradual development of trade and industry forced the canon lawyers into a number of legal fictions which practically nullified the rule against usury. With the Reformation, Martin Luther permitted usury as a concession to human frailty. John Calvin took a positive stand in favor of usury, but not above a rate legally fixed. The rise of modern capitalistic enterprise removed the last opposition to interest. Laws limiting the legal rate, defensible where consumption loans are concerned, still exist.

A. B. W.

URUGUAY

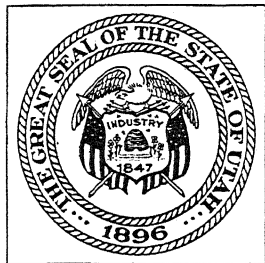


1. COURTESY MUNSON STEAMSHIP LINE; 2. CONSULATE GENERAL OF URUGUAY; 3. 4. INTERNATIONAL TELEPHONE AND TELEGRAPH CORP.

MODERN CIVILIZATION IN URUGUAYAN CITIES

1. The Casa Rosada at Montevideo, official residence of the president of Uruguay and location of the executive offices of the government. 2. Pocitos Beach, near Montevideo, a principal seaside resort. 3. Montevideo, capital of the Republic, from the air. 4. The National University of Uruguay.

UTAH, one of the western states of the United States, which is situated between the parallels of 37° and 42° N. lat. and 32° and 37° W. long. On the north it is bounded by Idaho and Wyoming, on the east by Wyoming and Colorado, on the south by



UTAH STATE SEAL

Arizona and on the west by Nevada. Utah comprises an area of 84,990 sq. mi., inclusive of 2,806 sq. mi. of water surface, with an extreme length of 345 mi. from north to south and an extreme breadth of 280 mi. from east to west. In size Utah ranks tenth among the states of the Union.

Surface Features. Utah is divided among three major physiographic provinces: the Rocky Mountains, Colorado Plateaus, and Great Basin. The mean elevation of the state as a whole is 6,100 ft. above sea level, and its relief varies from 2,000 ft. at Beaverdam Creek in Washington Co., to 13,498 ft. on Kings Peak in Duchesne Co.

The Wasatch range of the Rockies extends into northern Utah from Idaho, terminating just north of Nephi. East of it, just below the Wyoming boundary, are the Uinta Mountains, an east and west range with many peaks and crests over 12,000 ft. high. The Green River flows across it through the canyon of Ladore.

The Colorado Plateaus have several subdivisions known as the High Plateaus, the Canyon Lands and the Rock Terraces. The High Plateaus occupy the central part of the state south of the Wasatch Mountains, and cover a belt 30 to 150 mi. wide. On the west they overlook the Great Basin from a superior height of 3,000 to 5,000 ft., on the east decline to the Canyon Lands, and on the south terminate with the Rock Terraces. They are in the truest sense plateaus, having almost flat surfaces and horizontal strata, and are arranged in three longitudinal strips with valleys between. The western belt consists of the Gunnison, Pavant, Tushar and Markagunt; the central plateaus are the Sevier and Paunsagunt; and those on the east the Wasatch, Fish Lake, Awapa and Aquarius. The eastern depression is called the Grass valley, and the western the Sevier valley since it is traversed for 125 mi. by the Sevier River and a tributary, the San Pitch. With irrigation this valley has become one of the most important agricultural sections of Utah.

Of these plateaus, a typical one is Sevier which is 70 mi. long, 10 to 20 mi. wide, and more than 10,000 ft. high. It overlooks Sevier valley to the west from the top of a great escarpment of dark volcanic rock, in places more than a mile high. Aquarius plateau in Garfield Co. is the loftiest and most beautiful of the group. It attains a height of 11,600 ft., supports a dense spruce forest and numerous lakes, and is bounded by cliffs sometimes 6,000 ft. high.

The descent from the southern end of the High Plateaus to the Grand Canyon district of Arizona is by a series of great rock terraces with an aggregate height of 6,000 ft. They are successively, the Pink, White, Vermillion and Chocolate cliffs. Their edges are indented by branching canyons and carved into architectural features. Where the Pink Cliffs face the Paunsagunt plateau they are weathered into a colonnade and indented by Bryce Canyon. The White Cliffs, so-called for their white sandstone formation, are about 1,000 ft. high and decorated with delicate filigree patterns wrought by the wasting of softer substances. The Vermillion Cliffs are sandstone of a rich red color, carved into sturdy columns and majestic buttresses. To the southwest are the Chocolate Cliffs named for their rich, deep coloring.

The Canyon Lands which occupy southeastern Utah are limited on the north by the Uinta Mountains and continue into Colorado and Arizona on the east and south. The Colorado River flows diagonally across them in a deep, ragged canyon, receiving tributaries from similar canyons sometimes 1,000 ft. deep. East of the Colorado and north of the San Juan is the Great Sage Plain, an arid region where streams are few and the vegetation mainly sagebrush and cactus.

The Great Basin region, which extends from Nevada into western Utah, has a surface about equally divided between short, isolated mountain ranges and desert basins, and is unique in that the drainage has no outlet to the sea. The permanent streams which originate in the Wasatch Mountains and High Plateaus form lakes in the basins where they terminate. Such lakes, of which Great Salt, Sevier and Utah are examples, become saline and vary greatly in size from year to year. They are remnants of the ancient Lake Bonneville which covered 19,750 sq. mi., the shore line of which is marked on the ranges 1,000 ft. above the desert. Great Salt Lake desert in Tooele Co. and the Escalante desert in Iron Co. are true desert areas.

Climate. On the whole the climate of Utah is extremely variable, summers being very warm and winters often severe. The mean annual temperature for the state is 47.9° F., ranging from about 58° F. in the south to about 42° F. in the north. At Salt Lake City the average for January is 29.2° F. and for July 75.7° F. During the period 1892-1930 the highest temperature recorded in Utah was 116° F. and the lowest -50° F. The average annual precipitation is 14.3 in., including 50.2 in. of snow, varying from 16.1 in. at Salt Lake City to 2.3 in. at Hite in the desert of southeastern Utah. The average growing season at Salt Lake City is 183 days.

Forests and Parks. Practically all the forest land in Utah is included in the eight national forests, Ashley, Cache, Dixie, Fishlake, La Sal, Manti, Minidoka, Powell, Uinta, and Wasatch which are located in mountainous country and have a total net area of 7,497,644 acres. A coniferous forest which has been largely cut over originally covered the mountains, and is generally regarded as a southward ex-

tension of the northern evergreen forest. In ascending altitude zones, the western yellow pine is the first and most abundant forest tree, especially in the southern part of the state. Next comes the Douglas fir and white fir. Lodgepole pine also forms extensive stands in this zone in the Uinta Mountains. Above 9,000 ft. the characteristic species are Engelmann spruce and alpine fir.

Utah has many places of scenic, geological and archeological interest which offer excellent possibilities for state parks but as yet none have been developed. Federal developments are BRYCE and ZION NATIONAL PARKS and DINOSAUR, NATURAL BRIDGES, RAINBOW BRIDGE, and TIMPANOGOS national monuments.

Minerals and Mining. Utah is exceedingly rich in ore deposits bearing gold, silver, copper, lead and zinc, and is one of the leading states in the production of the precious and semiprecious metals. The yield of these metals in 1929, valued at about \$96,000,000, constituted five-sixths of the total mineral output of the state. Aside from the metals bituminous coal is the most important mineral product.

With a total output in 1929 amounting to \$115,130,581, Utah stood thirteenth among the states, ranking first in silver, second in copper, lead and asphalt, third in gold and sulphur, fifth in zinc and tenth in value of coal. It also stood eighth in quantity of iron ore mined. The outstanding product was copper, 318,282,523 lbs. valued at \$56,017,724. Other products of importance in order of value were lead, 149,377 tons, \$18,821,529; coal, \$13,145,832; silver, 17,592,396 oz., \$9,376,747; zinc, 51,510 tons, \$6,799,286; gold, 240,420 oz., \$4,969,915; asphalt and bituminous rock, \$1,479,832; and clay products, excluding pottery, \$1,028,342.

During 1929 135 mines and quarries gave employment to 13,098 persons who received \$23,916,616 in salaries and wages.

Soil. In the flood plains of the larger rivers, in the valleys between the high plateaus, and also in the desert basins there are very fertile alluvial soils, which under irrigation are highly productive. In limited areas adjacent to the mountains the soils are also very rich and well adapted to the raising of crops. Extensive areas in the higher plateau districts cannot be cultivated and most of the western and southeastern parts of the state are unreclaimable deserts because of their poor sandy soil and numerous alkaline deposits. In some districts excess alkali can be washed away by proper drainage and with irrigation the soil becomes highly productive.

Agriculture. The chief crops are hay, grain, vegetables, sugar beets and fruits.

In 1930 5,613,101 ac. or 10.7% of the entire land area was in farms, 27,159 in number, with an average size per farm of 206.7 ac. and an average value per acre of \$39.41. Of the farm area 1,495,497 ac. was crop land, and 3,661,777 ac., pasture land. The total value of farm property was \$289,118,388, of which \$221,223,172 was represented by land and buildings; \$13,636,571, by implements and machinery; and \$54,258,645, by domestic animals.

According to the census of 1930 Utah produced in 1929 field crops to the value of \$35,260,151, ranking thirty-eighth among the states. It stood third in sugar beets and fifth in peas. The chief crops were hay, \$14,861,769; grain, \$8,776,180; vegetables, \$5,209,011; sugar beets, 545,291 tons; \$3,844,302, and fruits, \$2,537,395. Of the hay crop of 1,372,709 tons, alfalfa furnished 1,213,525 tons or 88%. The grains included wheat, 5,309,953 bu.; oats, 1,741,902 bu., and barley, 1,453,021 bu. Among the leading vegetables were potatoes \$2,157,686; tomatoes, \$769,221, and green peas, \$593,779. The chief fruits were apples, 610,449 bu., peaches, 604,038 bu.; cherries, 113,589 bu.; strawberries, 2,526,485 qts., and raspberries, 1,002,329 qts.

Farm products sold by cooperative marketing rose from \$1,105,523 in 1919 to \$4,263,917 in 1929. Farm machinery and equipment in 1930 included 17,574 automobiles, 4,189 motor trucks, and 1,426 tractors.

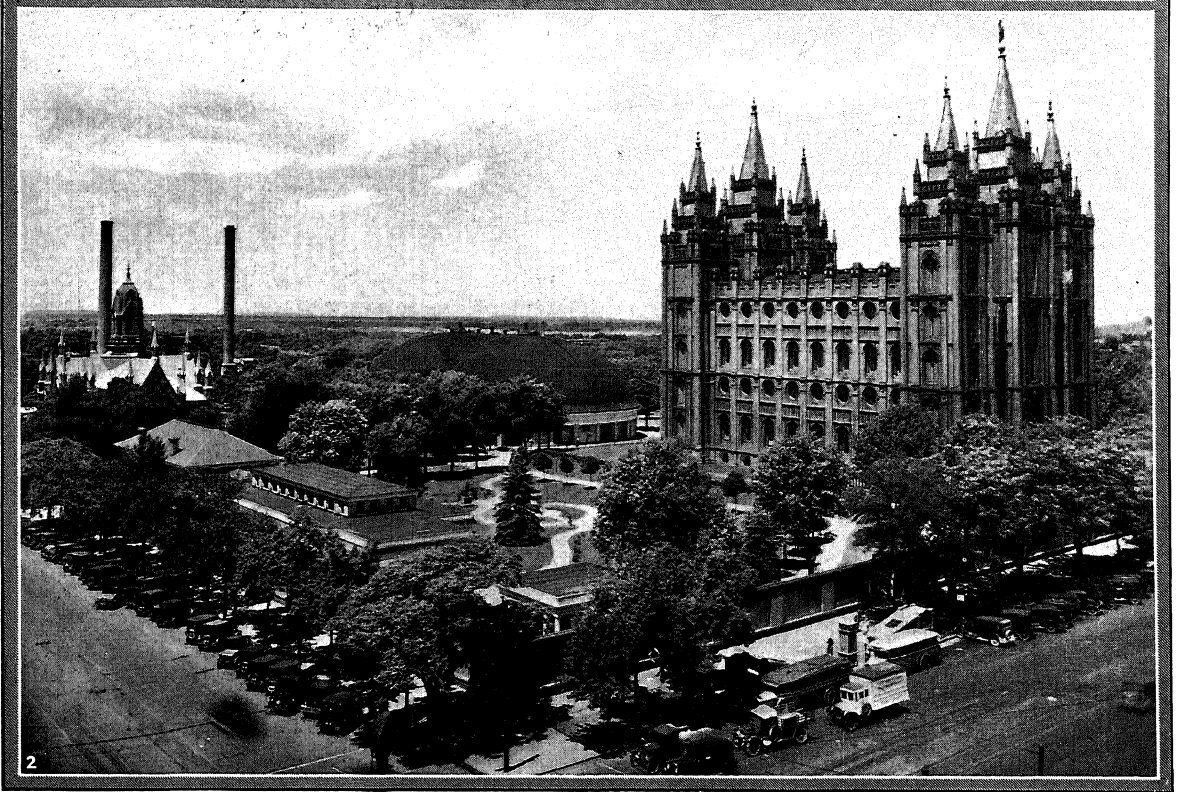
Irrigation. The Mormon pioneers in Utah were the first to establish irrigation in the West on a large scale. Before 1860 they had placed over 120,000 ac. under irrigation, which is necessary to crop production practically throughout the state. In the census of 1930 irrigation operations are reported separately for each of the 29 counties. The most extensive developments are in the drainage basins of streams flowing into Great Salt Lake, the Colorado and the Sevier rivers and their tributaries. Irrigated farms comprised 88% of the number and 90% of the value of all farms in Utah. Nine-tenths of the crop land was irrigated. The proportion irrigated is 23.6% of the area of all land in farms and 2.5% of the land area of the state.

The total number of irrigated farms was 23,847, with an aggregate area of 4,137,021 ac., of which 1,324,125 ac. were irrigated. Including land and buildings the value of all irrigated farms was \$199,983,735, or an average of \$48.34 per ac. The total investment in irrigation enterprises to 1930 was \$35,669,819 and the average cost of maintenance and operation for 1929 was \$1.00 per ac.

Animal Industry. Cattle-raising and sheep-raising are the chief livestock interests. According to the census of 1930 Utah stood seventh among the states in number of sheep on farms and fourth in pounds of wool shorn. The state ranked thirty-fifth in total value, \$54,258,645, of domestic animals on farms. Among these were sheep, 2,922,457, valued at \$23,233,376; cattle, 441,650, \$23,185,236; horses, 91,218, \$4,720,401; mules, 2,906, \$154,487; swine, 67,196, \$783,313, and goats, 72,007, \$322,157.

Of the cows on farms, 125,364 were kept mainly for beef production and 119,960 mainly for milk production. In 1929, 65,039,328 gals. of milk were produced; the total value of dairy products sold was \$9,360,915. The wool clip, 19,596,962 lbs., was valued at \$5,842,643. The poultry raised, with a value of \$3,479,177, included chickens, 3,539,809 in number valued at \$2,799,106, and turkeys, 228,483, \$653,917. Of 18,462,515 doz. chicken eggs produced, valued at

UTAH

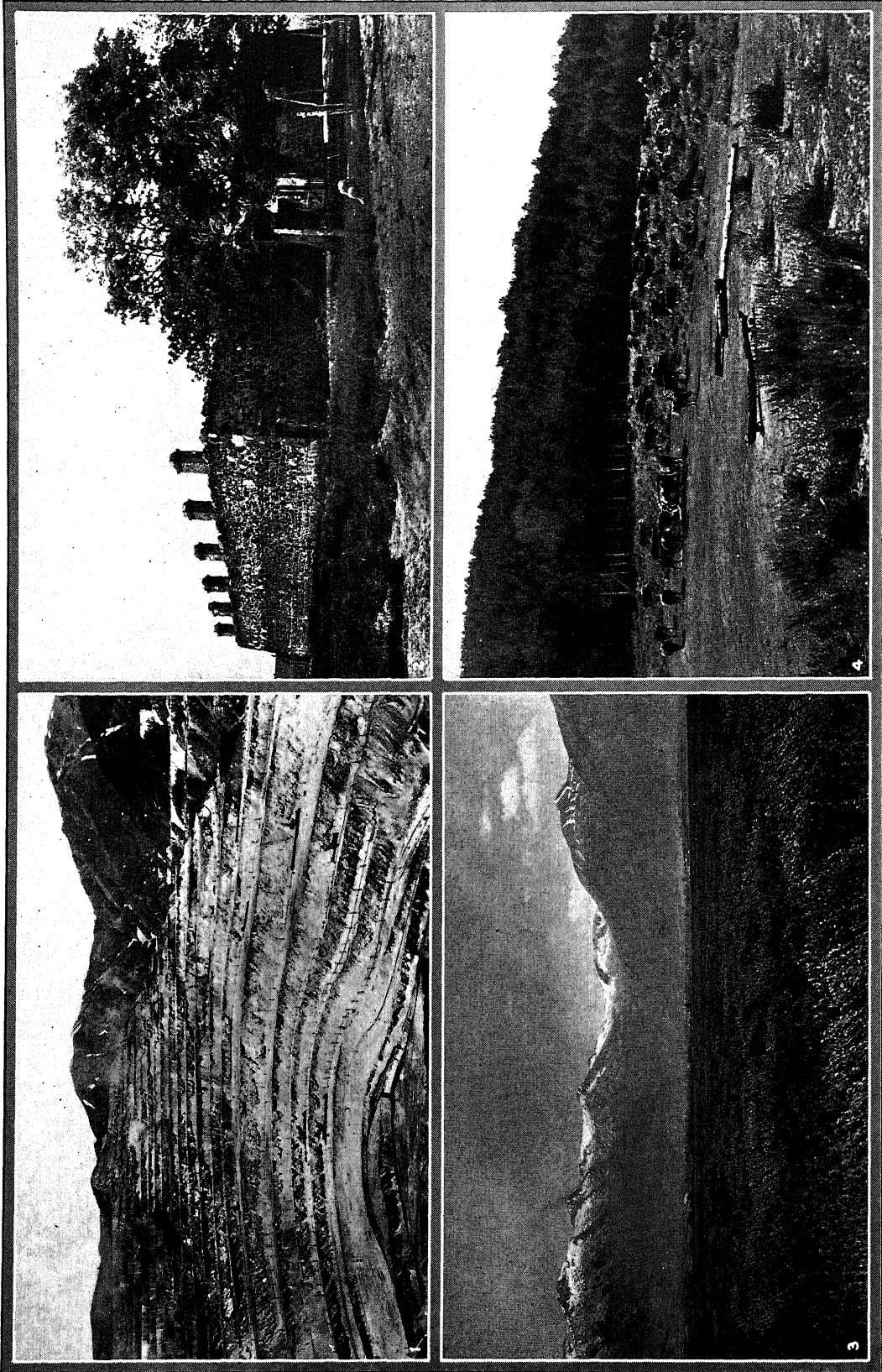


COURTESY SALT LAKE CITY CHAMBER OF COMMERCE

UTAH'S CAPITOL AND THE MORMON TEMPLE, SALT LAKE CITY

1. The new State Capitol at Salt Lake City, built in 1916 of marble and Utah granite.
2. Mormon Temple in Temple Square, built in 1853-93. The building is of granite, the highest spire 220 ft. in height.

UTAH



INDUSTRIAL AND HISTORIC VIEWS IN UTAH

1. Copper mine at Bingham, largest open-cut mine in North America.
2. Cove Fort, built by the early Mormons as a refuge from the Indians.
3. American Fork Canyon, Utah, with snow-topped Rockies in background.
4. Snows stored in the Wasatch range provide moisture for grazing.

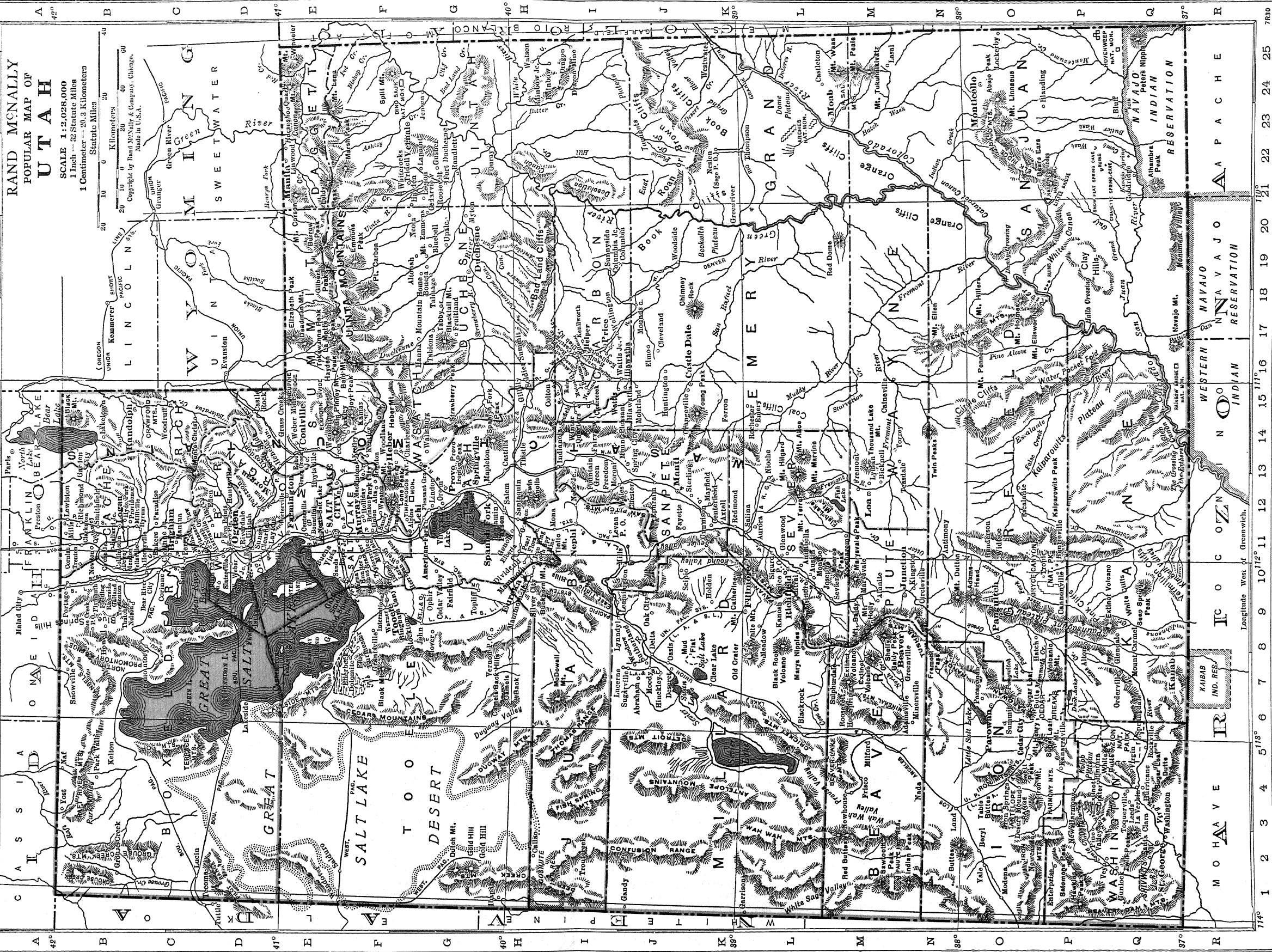
UTAH

Area 84,990 sq. m.
Pop. 507,847

PRINCIPAL CITIES

Pop. Thousands	
3	American Fork
3	Beaver
3	Bingham
3	Bountiful
3	Brigham
3	Cedar City
3	Delta
3	Draper
3	Ephraim
3	Eureka
3	Fairview
3	Farmington
3	Hillmore
3	Kanab
3	Midvale
3	Monroe
3	Morgan
3	Moroni
3	Mt. Pleasant
3	Murray
3	Nephi
3	Ogden
3	Orem
3	Panguitch
3	Park City
3	Parowan
3	Payson
3	Pleasant Grove
3	Price
3	Providence
3	Provo
3	Richfield
3	Richmond
3	Riverton
3	Roosevelt
3	St. George
3	Salina
3	Salt Lake City
3	Sandy
3	Santaquin
3	Smithfield
3	Spanish Fork
3	Spring City
3	Springville
3	Tremonton
3	Vernal
3	Wellsville
3	Woods Cross
3	Winter Quarters

Pop.—Hundreds	
6	Aurora
6	Blanding
6	Castle Dale
6	Castlegate
6	Centerfield
6	Centerville
6	Clarkston
6	Clearfield
6	Coalville
6	Duchesne
6	Elsmore
6	Emery
6	Escalante
6	Garland
6	Goshen
6	Hiawatha
6	Hinckley
6	Holden
6	Hunter
6	Huntington
6	Huntsville
6	Hyale Park
6	Kamas
6	Kanosh
6	Layton
6	Levan
6	Lindon
6	Mapleton
6	Midway
6	Moab
6	Newton
6	Redmond
6	Salem
6	Sunnyside
6	Willard
6	Winter Quarters



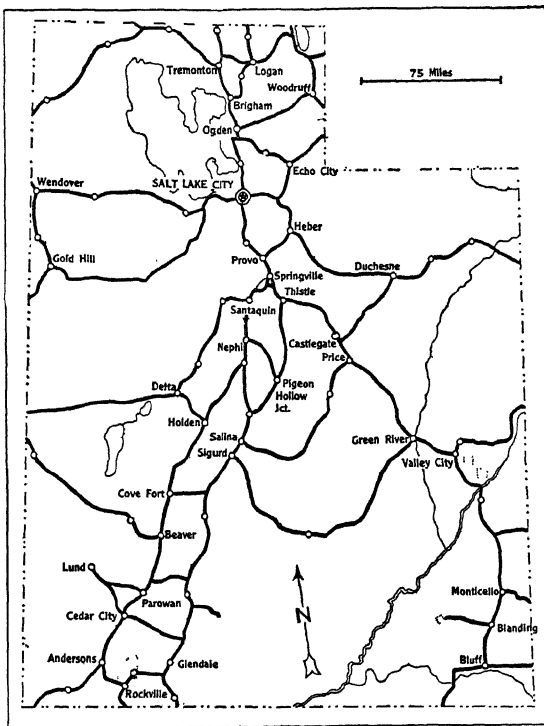
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\$5,313,069, 15,339,993 doz., with a value of \$4,410,003, were marketed. Honey, amounting to 3,149,537 lbs. valued at \$280,180, was produced from 53,581 hives.

Fisheries. There is no commercial fishing in the state, but the lakes and streams tempt the sportsman. In 1930, the state issued 60,000 fishing licenses, receiving \$150,000 in fees. Eight fish hatcheries were operated at a cost of \$64,000, and the year's output was 11,000,000 trout. The U.S. Bureau of Fisheries maintains an important egg collection and hatching station at Springville. During 1930 526,176 silver salmon, 2,126,000 rainbow trout, 270,000 loch leven trout, and 499,000 brook trout were planted in state waters.

Transportation. The rivers of Utah are not navigable. In 1930 the total steam railway mileage in the state was 2,194. The Union Pacific, the first railroad to enter Utah, is the principal line, but the Denver and Rio Grande, the Southern Pacific and the Western Pacific are also important.

The mountainous character of the region has made the development of an adequate highway system extremely difficult. Including the principal through routes, there were 27,666 mi. of highways in the



UTAH STATE ROADS

state on Jan. 1, 1930, of which 4,237 mi. were surfaced roads and 1,795 mi. improved state highways. During 1929, highway expenditures were \$5,343,550. Of this amount \$4,106,131 was paid by the state and \$1,237,419 by county and local governments. Gasoline consumption during 1930 aggregated 60,137,000

gals. The state gasoline tax that year produced an income of \$2,105,529 as against \$1,258,009 in 1926. Motor vehicle registrations were 113,997 in 1930 compared with 73,427 in 1925, a gain of about 55%. The rapid growth of transportation by truck is indicated by registrations, which rose from 10,475 in 1925 to 17,869 in 1930, approximately 70%. During the same period the number of buses in operation increased from 443 to 583.

Manufactures. The manufactures of Utah, which during the 25-year period 1904-1929 increased in value 450%, are based on the state's varied mineral and agricultural resources.

According to the census of 1930 Utah with manufactures for 1929 valued at \$214,628,855 stood thirty-eighth among the states. Its 651 establishments gave employment to 2,909 officers and employees, who received \$6,407,917 in salaries, and to 15,601 wage earners, who were paid \$19,698,684 in wages. These factories used a total of 123,737 horse power, expended \$7,453,051 for fuel and power, and \$150,448,970 for materials and supplies, and added by the process of manufacture \$56,726,834 to the value of their output.

In this output the products not separately enumerated, which included the output of important metal smelting plants and various other factories, were valued at \$95,528,791. Among the 38 groups of products separately reported were lead smelting and refining valued at \$38,820,392; flour, \$9,901,834; canned fruits and vegetables, \$9,160,379; beet sugar, \$9,114,204; meat packing, \$8,935,640; steam railway carshop construction, \$6,207,955; butter, \$5,567,581, and bread, \$5,013,072.

The principal manufacturing cities with value of output were Salt Lake City, \$43,255,519, and Ogden, \$19,064,613.

Commerce. According to the census of 1930, there were in 1929 736 wholesaling establishments in Utah, with total sales of \$180,101,474. These organizations gave full-time employment to 5,737 men and women, whose annual salaries and wages aggregated \$9,711,667. The chief wholesaling center was Salt Lake City, with a volume of \$133,566,205.

The total sales of the 5,291 retail stores amounted to \$200,041,805. Sales per store averaged \$37,808; sales per capita were \$393.90.

CHIEF RETAIL DISTRIBUTING GROUPS

Group	No. of Stores	Sales	% of Total
Automotive	1,062	\$45,026,074	22.51
General Mdse.	570	42,930,888	21.45
Food	1,392	34,235,599	17.13
Lumber & Bldg.	282	15,454,264	7.74
Apparel	351	14,234,469	7.13
Furn. & Household ..	157	12,275,912	6.13
All other stores	1,477	35,884,599	17.91
Total, all stores ...	5,291	\$200,041,805	100.00

Finance and Banking. The assessed value of all property in 1930 was \$728,364,055. The gross bonded debt was \$10,610,000, less sinking funds of \$5,293,500. Total state revenues in 1930 were \$18,953,812; total

disbursements, \$18,492,349. The chief sources of income were from land grants and taxes on property, motor vehicles and gasoline, \$2,226,488. The principal payments were for highways, \$3,875,975, education, \$3,238,596, and administrative expenses.

Since 1859, when the first bank was opened by Walker Brothers in Salt Lake City, Utah's banking system has been on a sound basis, commanding public confidence. There were 100 banks here in 1930, of which 17 were national banks and 83 trust companies and state banks. Their total capitalization was \$11,871,000; their surplus and undivided profits, \$8,903,000. Total resources were \$195,640,000, with loans and discounts aggregating \$119,929,000. Demand and time deposits totaled \$129,619,000. Per capita demand and time deposits were \$256.67; per capita savings deposits, \$134.73. The total savings of \$68,038,000 were owned by 221,650 depositors. National bank circulation aggregated \$2,489,000.

Government. The legislative body of Utah consists of a Senate composed of 20 members and a House of Representatives of 55 members, the former elected for terms of four years and the latter for terms of two years. They meet in biennial sessions limited in duration to 60 days. The chief executive is the governor elected for terms of four years at a salary of \$6,000 per year. Other executive officers are the secretary of state, auditor, treasurer, attorney-general, and superintendent of public instruction. Judicial power is vested in a supreme court, in district courts, in justices of the peace, and in inferior courts. The supreme court consists of five judges elected for terms of ten years at salaries of \$5,000 per annum.

Social Welfare Institutions. There are an industrial school for delinquent boys and girls and schools for the deaf and blind at Ogden. At Provo is a mental hospital and the state prison is at Salt Lake City.

Education. The first schools were established by the Mormons soon after they settled in Utah in 1847, and the University of Deseret was opened in 1850. The first general school law was enacted in 1854, and by 1862 there were 62 schools in the territory. In 1928 there were 712 public school buildings, having 133,829 pupils enrolled in the public elementary and high schools. There were 2,954 elementary teachers and 1,522 high school teachers. Children from 8 to 16 years of age are required to attend school 20 weeks of the year.

The number of persons from 5 to 20 years of age attending school in 1930 was 141,399, or 76.8% of the population within the ages specified, as compared with 116,385, or 73%, in 1920. The number of persons, 10 years and over, unable to read and write in 1930 was 4,640, or 1.2%, as compared with 6,264, or 1.9%, in 1920.

Among the institutions of higher learning are the University of Utah at Salt Lake City, and the Agricultural College of Utah at Logan, both controlled by the state; Brigham Young University at Provo, Snow College at Ephraim and Weber College at

Ogden. The State Library secretary and organizer has headquarters in the State Capitol, Salt Lake City.

Population. In 1930 Utah ranked fortieth among the states with a population of 507,847 or an average of 6.2 per sq. mi., an increase of 58,451 or 13.0% over 1920. The population rose from 11,380 in 1850 to 276,749 in 1900, 373,351 in 1910 and 449,396 in 1920. In 1930 there were 495,955 or 97.7% whites, 4,012 or 0.8% Mexicans, 3,269 or 0.6% Japanese, 2,869 or 0.6% Indians, and 1,108 or 0.2% Negroes. Of the whites 452,183 were native-born and 43,772 were foreign-born, a decrease in the latter of 12,683 from 1920. Of the total foreign stock, including foreign-born, foreign and mixed parentage, 59,177 or 33.3% were English; 24,895 or 14.0%, Danish; 15,838 or 8.9%, Swedish; 12,338 or 7.0%, German. The urban population was 266,264 or 52.4% of the total, an increase of 50,680 or 23.5% from 1920; the rural population was 241,583 or 47.6% of the total, an increase of 7,771 or 3.3% since 1920. There were in 1930 three cities of 10,000 and upwards: Salt Lake City, 140,267; Ogden, 40,272; Provo, 14,766.

Occupations. In 1930 170,000 persons, or 33.5% of the population, were gainful workers 10 years old or older; 83% of these were males and 17% were females; 83.6% were native white; 13.3% foreign-born white, and 2.8% other races. Among the chief occupations, with number of workers, were agriculture, 41,247; manufacturing, 36,969; trade, 22,124; transportation and communication, 15,408; domestic and personal service, 13,807; professional service, 13,552; clerical service, 13,094, and mining, 10,514.

HISTORY

The first Europeans to visit Utah were Spaniards, an expedition dispatched by CORONADO from his headquarters at Cibola in 1540. The first extensive exploration occurred in 1776, when two Franciscans, Fathers Escalante and Dominguez, from Santa Fé traveled to Utah Lake, thence headed southwest to the Sevier River and desert. James Bridger, the American trapper, made known the Great Salt Lake in 1825. Other trappers established themselves in the region. Jedediah Smith's exploration from Great Salt Lake in 1826 was first to penetrate any distance into the great basin west of the lake. Frémont's published journals included a favorable account of the region just east of the lake, and probably influenced Brigham Young in his decision to lead the MORMONS into Utah. Caravans of emigrants to OREGON and CALIFORNIA had already passed through Utah. The history of the actual settlement of the state began on July 24, 1847, when the first company of Mormons—about 150 people, with 73 wagons laden with seeds and implements—reached the Salt Lake Valley. By the end of autumn, 1847, some 2,000 Mormons had arrived; by 1852 the settlement numbered 15,000. Able proselyting by Mormon missionaries in the eastern states, in England and on the European continent, fed the stream of immigration. The directing genius of Brigham Young, the super-

vision of economic and social activities by the centralized administration of the Mormon Church, magnificent irrigation projects which transformed apparently inhospitable regions into areas of intensive agriculture, offered the settler a subsistence and often a surplus. Salt Lake City, the initial foothold, remained the metropolis and political center; sites for new settlements were chosen carefully, preferably in fertile valley land with water available for irrigation. As gold-seeking was discouraged by the governing hierarchy, Utah remained primarily agricultural, with few but local manufactures; but the coming of the Union Pacific in 1869 greatly stimulated mining.

A Mexican domain when the Mormon occupation began, Utah passed to the United States as part of the Mexican Cession of 1848. (*See GUADALUPE-HIDALGO, TREATY OF*). The "State of Deseret" was spontaneously erected in 1849; Congress refused to admit the state, but organized the Territory of Utah, Sept. 9, 1850, including the present Nevada. The appointment of Brigham Young as first governor facilitated Mormon control of the government. Six separate endeavors for statehood were negated by Congress because of ill-feeling between Gentiles and Mormons and because of objection to polygamy among the Mormons. In 1890 the Church refused to sanction plural marriage, and on Jan. 4, 1896, Utah became a state.

Since 1903 REED SMOOT has been the leading political figure of Utah, but in the 1932 election his long term of office as senator was broken when he was defeated by Elbert D. Thomas, Democrat. Henry H. Blood was elected governor in the same election.

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UTAH, UNIVERSITY OF, at Salt Lake City, a coeducational state institution, founded in 1850 as the University of the State of Deseret. Because of the lack of funds, it was closed after one session, but was reopened in 1867. In 1894 the institution became the University of Utah, and received a tract of land from the Federal Government. It comprises schools of Arts and Sciences, Education, Mines and Engineering, Medicine, Commerce and Finance and Law, a Graduate School and an Extension Division. The grounds and buildings were valued in 1931 at \$1,700,000. The library contained 95,319 volumes. In 1930-31 there was a student enrollment of 3,317 and a faculty of 196 headed by Pres. GEORGE THOMAS.

UTE, a tribe of North American Indians speaking a dialect of the Shoshonean linguistic stock. Their territory comprised central and western Colorado, eastern Utah and the region of the upper San Juan River basin in New Mexico. Though originally a typically Plateau people with a slight admixture of southwestern traits, the Ute now show many traces of Plains culture, such as skin-covered lodges and buffalo robes. The Wolf and Coyote feature largely in their mythology. They are lacking in elaborate ceremonies and rituals. The principal celebration is the Bear Dance performed every spring by both men and women. In 1931 approximately 2,000 Ute were liv-

ing on reservations in northeastern Utah and southwestern Colorado.

UTERUS, or **WOMB**, a pear-shaped, flattened hollow, muscular organ situated in the mid-line at the upper part of the female pelvis. The uterus serves for protection of the developing embryo, and its muscular walls aid in its expulsion at maturity. It opens below into the vagina, and at the top, on either side, into the fallopian tubes. (*See GENERATIVE ORGANS.*)

Though the uterus normally inclines forward, it may become tilted backward or retroverted. Painful menstruation may be a sign of a displaced uterus. In later life it is frequently the seat of tumors. Though the tumor may be of a benign type, the great frequency and seriousness of **CANCER** in the uterus should induce one to view with grave suspicion any abnormalities in menstruation, pelvic or back pain in late life. *See also* POLYPUS.

UTICA, in ancient times a city of Africa, 25 mi. north northwest of Carthage, was founded by Phoenicians in 1101 B.C. It was an important seaport but coast line changes have moved the site inland. It was taken by Agathocles in 310 B.C. and later took part in the Punic Wars. After the fall of Carthage in 146 B.C. when Rome increased its territory, Utica succeeded Carthage as the most important city of Africa and became the capital of the province. It was here that Cato took his life following the triumph of Caesar's victory at Thapsus in 46 A.D. Utica fell into the hands of the Vandals in 439 and of the Byzantines in 534. In 698 the Arabs destroyed the city. There are ruins of baths, reservoirs, fortifications, an aqueduct, acropolis and immense amphitheater, which seated 20,000 persons, but no tower exists on the site to-day.

UTICA, a city in central New York, the county seat of Oneida Co., situated on the Mohawk River and the State Barge Canal, 238 mi. northwest of New York City. Several railroads, a municipal airport, bus and truck lines and canal barges serve the city. The principal manufactures are heating and ventilating apparatus, textiles, men's clothing and metal products. In 1929 the factory output was valued at about \$65,000,000; the wholesale trade proper amounted to \$40,178,744 and the retail trade, to \$56,845,986. A plant at Trenton Falls, 15 mi. north, supplies hydroelectric power. It was incorporated as a village in 1798. The city was chartered in 1832. Pop. 1920, 94,156; 1930 101,740.

UTILITARIANISM, a movement in ethics that would judge the worth of moral acts by their tendency to produce happy consequences. It found its best expression in England during the early and middle parts of the 19th century and is closely associated with the names of JEREMY BENTHAM and JAMES and JOHN STUART MILL. Opposed to any form of intuitionism, the utilitarians aimed at the betterment of man's lot by holding him responsible for the consequences of his acts, and influenced legislation as a means of controlling the environment. The movement was a wholesome one and did much to alleviate the

wretched conditions which had resulted from the Industrial Revolution.

Utilitarianism would measure the consequences of an act by its tendency to produce happiness. Happiness was thought of in terms of pleasure and pain. Pleasure and pain were the great driving forces, not only the springs to action but the standard by which acts should be judged. This hedonistic evaluation found its extreme expression in Bentham's felicific calculus, by which the ledger of happiness might be balanced up by a consideration of the pleasures against the pains. Nevertheless the utilitarians had a criterion for judging the kind of pleasures that should be sought. This was found in the greatest good of the greatest number. Although it is perhaps inconsistent with his hedonistic theory of desire, this principle was accepted by Bentham. Mill made a qualitative distinction, not allowed by Bentham, between pleasures.

UTOPIA, a name applying to a class of literature, which attempts to picture the customs and institutions and inventions of a more rational society; a word coined by THOMAS MORE referring to two Greek words, *outopia* or no-place, and *eutopia* or the good place. While the notion of an ideal society was characteristic of Greek thought, similar tendencies are found in the Jewish prophets.

Utopias may be divided into Utopias of escape, and reconstruction. The first would include visions placed definitely in the hereafter, and merely literary pictures of a different world, such as Bulwer-Lytton's *The Coming Race* or W. H. Hudson's *The Crystal Age*; the second attempts to understand the nature of human society, and to provide a more rational and humane basis for it. To this second class belongs the first and perhaps most satisfactory of Utopias, Plato's *Republic*, which emphasized a rational method of human breeding, a rigorous method of education, a common moral ideal, and a just economic order in which human welfare transcends the claims of property. The next important essay was Sir Thomas More's *Utopia*.

The writing of Utopias was a characteristic phase of Renaissance thought. The best Utopia after More's is Johann Valentin Andreae's *Christianopolis*, although Bacon's *New Atlantis* and Campanella's *City of the Sun* are better known. The subject degenerated into an instrument of romance until the 19th century, when this idealistic mode of thought was revived by FOURIER, OWEN, CABOT and Buckingham, and various more or less abortive attempts to establish actual Utopias were made in America by their followers. Whereas earlier Utopias stressed the moral and institutional means of regeneration, the latter ones followed More and Andreae in placing greater dependence upon a new economic order. This was particularly true of Edward Bellamy's *Looking Backward*, Theodor Hertzka's *Freeland*, Theodor Herzl's *Altneuland*, and H. G. Wells's *A Modern Utopia*. With Herzl's Utopia and with Ebenezer Howard's *Tomorrow* utopian literature entered the realm of

practicability. *Altneuland*, a very intelligent survey of the problem of Jewish repatriation in Palestine, became one of the foundation stones of the Zionist movement, while *Tomorrow* became the rallying center of the Garden Cities movement.

Apart from their many remarkable anticipations of later inventions and institutions, Utopias have been important in their representation of prescientific sociological thought at its best. In their effort to grasp the totality of human society, and to deal in a unified way with its moral and economic life, its arts and sciences, its cities and landscapes, the Utopias of reconstruction have respected certain concrete elements of actual life that were ignored in more abstract political discussions; and they have often escaped the errors of specialized thinking. Even when they are divorced from actuality, as in William Morris's *News from Nowhere*, they serve as powerful weapons of satirical criticism. In this later phase they blend in with such negative Utopias as Swift's *Gulliver's Travels* and Butler's *Erewhon*. L. Mv.

UTRECHT, capital of the Dutch province of the same name, located on the Old Rhine connected by waterways with the Zuidersee and the North Sea and transected by two arms of the Old Rhine which are strongly fortified. The capital consists of the city and four suburbs with 20 churches, the most noteworthy being the Reformed Cathedral, a splendid Gothic building erected in 1254-67. Important also are the former academy, once the cathedral chapter house, the new university buildings, and the former palace of King Louis Bonaparte; also the Pope's House, *Paushuizen*, founded by Pope Adrian VI, who was born here. The city hall and several museums are noteworthy. The manufactures include textiles, cigars, china, agricultural implements, chemicals, paints and machinery. Trade with these goods and with farm products is most active. Once a Roman settlement, the Franks and Frisians occupied it. A fortress was built in 630, and in 696 a bishopric was founded. Presented with rich presents by its emperors, it became a flourishing city in the 11th century. The bishops lost their secular power after struggles with the citizens. With the founding of the university in 1636, Utrecht became one of the first scientific cities in Holland and is to-day important as a railroad center. In 1713 the TREATY OF UTRECHT was signed, ending the War of the Spanish Succession. Pop. 1930, 154,975.

UTRECHT, TREATY OF. The settlements provided for by the treaties of Utrecht, Rastatt, and Baden, 1713-14 ending the WAR OF THE SPANISH SUCCESSION, by which the victors aimed to form a balance of power by establishing Austria and Holland in the Spanish Netherlands, Prussia on the lower Rhine, and Austria and Savoy in Italy. The important provisions were as follows:

1. Philip V, grandson of Louis XIV, was recognized as King of Spain and the Indies on condition that the crowns of France and Spain should never be united.
2. To Charles VI Spain ceded Naples, Milan

and Sardinia, and the Spanish Netherlands. 3. To England, Spain ceded Gibraltar and Minorca, thereby making England dominant in the Mediterranean; granted her a monopoly of the slave trade with the Spanish colonies for thirty years. (This clause was cancelled in 1750 upon payment to England of £100,000.) The "asiento" clause gave England the right to send one ship a year to Porto Bello in America. From France, England acquired Newfoundland, Acadia (Nova Scotia) and the Hudson's Bay region and therewith control of the fur trade and fisheries, and St. Christopher's in the West Indies. France recognized the right of the house of Hanover to the English throne. 4. Holland was given a line of frontier fortresses in the Austrian Netherlands for defense against France, and was allowed to establish a trade monopoly on the River Scheldt. 5. The Elector of Brandenburg was recognized as King of Prussia. 6. France was given the principality of Orange. 7. The Duke of Savoy received Sicily from Spain, and was recognized as King; in 1720 Austria forced the exchange of the island and title for Sardinia.

The consequences of the treaties were important: Spain was no longer handicapped by costly possession in the Netherlands and Italy, and was able to increase her power. Austria gained a firm foothold in Italy which she maintained until 1859. The French position was strengthened when the long rivalry between the Bourbons and Spanish Hapsburgs ended and France secured Spanish cooperation in her struggle with England. Great Britain strengthened her colonial and maritime power.

UVALDE, a city in southwestern Texas, the county seat of Uvalde Co. It is situated 76 mi. southwest of San Antonio and is served by two railroads. Farming is carried on in the district, and pecans and honey are special products. The city has asphalt and trap-rock industries. Pop. 1920, 3,885; 1930, 5,286.

UVEITIS. See BLINDNESS, MEDICAL ASPECTS OF.

UXBRIDGE, a town, including Uxbridge and several smaller villages, in Worcester Co., in southeastern Massachusetts. Uxbridge Village is situated on the Blackstone River, about 19 mi. southeast of Worcester; served by the New Haven Railroad. Woolen manufacture is the chief local industry. It was separated from Mendon in 1727 and incorporated as a town. Pop. 1920, 5,384; 1930, 6,285.

UZBEKISTAN or Uzbek S.S.R., one of the seven constituent republics forming the U.S.S.R., organized in 1925 from parts of Turkestan, Bokhara and Khorezm, whose wide plains stretch between the Syr-Darya and Oxus rivers. Its northern boundary is Kazakstan, its southern Afghanistan; to the east lie the Kirghiz autonomous republic and the Tadzhik S.S.R. and to the west the Turkmen S.S.R. Uzbekistan's area is 66,380 sq. mi. A very dry climate makes it necessary to carry on the pursuit of agriculture, the chief occupation, almost entirely under artificial irrigation. A large majority of the inhabitants are Uzbeks, Moslems of Aryan origin whose language is a peculiar Turkish dialect. In the southern and eastern portion are semi-nomadic Uzbeks whose culture and language are very distinctive. Other elements in the population are Tadzhiks, Turcomans, Kirghiz and Russians. Primitive and unsanitary dwellings and heavy Oriental clothing are characteristic. A patriarchal family organization, with widespread polygamy, and general illiteracy also exist, though the latter is on the decrease.

Uzbekistan is the chief source of cotton in the Soviet Union; the republic also produces wheat, rice, barley and fruit in large quantities. Approximately four-fifths of the inhabitants engage in farming. Sericulture and grape growing are important developments. In the cities, trading and industry flourish, and there are now more than 50 cotton-spinning factories. Among the natural resources are oil and coal. Railways exceed 1,100 mi. in length, including the Central Asiatic Railway, which connects Tashkent with the Caspian Sea. The Turkestan-Siberian line, whose southern termination is Tashkent, connects Uzbekistan with Siberia. SAMARKAND, the former capital and a prosperous cultural and commercial metropolis, had about 105,106 inhabitants in 1926; Tashkent, the present capital, had 323,544 in 1926 and 402,050 in 1930. Other cities are Bokhara, Khiva, Andizhan and Kokand. Pop. 1931, 4,685,400.

UZHOROD, the capital of Subcarpathian Ruthenia in Czechoslovakia and the seat of a Greek Catholic bishop. The city has a flying field, a 14th century castle and advanced schools. Furniture, chemicals and machines are manufactured. The inhabitants are Ruthenians, Slovaks, Magyars and Jews. Pop. 1921, 20,601; 1930, 26,669.

V

VAASA or **VASA**, capital of the Finnish province of the same name on the east coast of the Gulf of Bothnia. It is well supplied with educational institutions and has cotton, soap, sugar and milling industries. When the city of Vaasa, founded in 1606 by Charles IX of Sweden, burned down in 1852, the new city was built 6 mi. distant on the coast in 1855 and until 1917 was officially called Nikolaistad, in honor of Czar Nicholas I. Pop. 1930, 25,591.

VACCINATION. In 1798, EDWARD JENNER first published reports that a local inoculation with cowpox would prevent SMALLPOX. Vaccinia or cowpox is an acute infective disease of cows in which there is an eruption composed of blisters on the udders and teats. Waterhouse, in America, repeated Jenner's experiments and confirmed the resulting immunity. It has not been fully proved whether cowpox is an independent disease or smallpox that has been modified by passage through the cow.

In preparing material for vaccination, calves are vaccinated carefully on aseptically cleared spaces on the abdomen. The contents of the blisters formed are scraped, mixed with glycerine and stored until sterile. The material remains active for about two months.

In vaccinating, the skin is carefully cleansed with soap and water, and ether. A small scratch is made in the skin, without causing bleeding. A drop of the vaccinating material is put on the scratch and rubbed in with a needle. Methods for subcutaneous injection of the material are also used.

On the third day after vaccination, a pimple surrounded by a reddened area of skin occurs. On the sixth day, the pimple becomes a blister and the size of the red area increases. The vaccinated surface is now protected with a celluloid shield. On the eighth day the blister reaches its greatest size, and there is a depression in the top of it. On the tenth day the blister becomes filled with pus. The skin is swollen and painful. About the twelfth day, the pustule begins to dry up, forming a scab, and the redness of the surrounding skin decreases. About the twenty-first day the scab falls off, leaving the vaccination scar.

The other symptoms which occur vary in degree in different individuals. There may be a feeling of fatigue and restlessness. There is usually slight fever between the third and eighth days. The lymph glands in the armpit become slightly enlarged if the vaccination is on the upper arm, which is the usual site. There is an increase in the number of white blood cells.

Severe complications of vaccination are rare. Uncleanliness during the process may lead to secondary infection. Cases of TETANUS have been reported as the result of the use or contaminated vaccine. More recently, encephalitis has been reported in a few instances.

When an unvaccinated person is exposed to smallpox, immediate vaccination will usually prevent the disease, or if it does develop, the attack will be mild. Immunity is complete three weeks from date of vaccination. The duration of the protection is probably from ten to fifteen years.

The symptoms of vaccination are much milder in infants than in adults. Therefore, it is wise to vaccinate all children in infancy. (*See CHILDREN, DISEASES OF: Infectious Diseases.*) Vaccination should be repeated about the ninth year, and again about the eighteenth year. The degree of protection varies with the number of scars. *See also VACCINE THERAPY.*

W. I. F.

VACCINE THERAPY. Vaccines are preparations containing the live or dead bodies of bacteria, or viruses. Thus far, only vaccines containing dead bacteria are generally used in the United States. Vaccines containing living organisms have been perfected particularly for tuberculosis. Among these is the vaccine called B.C.G. (*Bacillus Calmette-Guerin*). (*See TUBERCULOSIS.*) Vaccines are distributed in the United States under a Federal law regulating the interstate sale of viruses, serums, toxins, and analogous products. It requires that each package be marked with expiration date and be kept under suitable conditions. Standards of potency have been set forth by the Hygienic Laboratory of the United States Public Health Service. The amount of antiseptic bodies for inclusion with various vaccines and serums is also controlled in this way.

The original vaccine was the type introduced by Edward Jenner for smallpox, and by Pasteur for vaccination against rabies. These are preventive vaccines rather than therapeutic.

Bacterial vaccines are not wholly established as useful in the treatment of disease, neither is their dosage established. Typhoid and paratyphoid vaccines, plague and cholera vaccines are used primarily in the prevention of disease. Vaccines of the acne organism are used both for prevention and treatment, but their exact value is not certain. Vaccines for whooping cough are also still in an exceedingly early experimental stage.

The Council on Pharmacy and Chemistry of the American Medical Association opposes vaccines containing the dead bodies of more than one type of organism for the reason that one organism plays the predominant rôle in most infections, and because there is little, if any, good evidence that mixtures of vaccines are superior in their effects to the use of vaccines of individual organisms whose use is based upon a bacteriologic study of the disease.

Autogenous vaccines are made by isolating the germs from the infection in the individual concerned. These germs are then grown on a culture medium,

killed, standardized as to their quantity, and reinjected into the patients. *See also* PREVENTION; THERAPEUTICS; VACCINATION. M. F.

VACCINIA. *See* VACCINATION.

VACUUM, literally, an empty space. In practice, any space occupied by a gas or vapor at less than atmospheric pressure. As a perfect vacuum is unattainable, the degree of exhaustion is described by giving the pressure exerted by the residual gas. The units used are the millimeter of mercury, or the micron, equivalent to 0.001 mm., and the microbar, a dyne force per square centimeter, or approximately 0.00075 mm. of mercury. The technique of vacuum production has undergone rapid development since about 1905 because of the importance of extremely high vacua in vacuum tubes (*see* TUBES, ELECTRONIC) used extensively in TELEPHONE and RADIO COMMUNICATION.

Production of Vacua. The original vacuum pumps, invented by OTTO VON GUERICKE about 1650 and ROBERT BOYLE in 1660, were similar in construction and operation to the force PUMPS used for moving liquids. Modern vacuum pumps may be grouped in three classes.

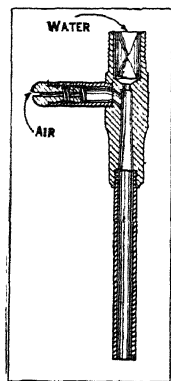


FIG. 1
WATER PUMP FOR
EVACUATING AIR

Water pumps, or aspirators (Fig. 1), are used extensively for the rapid exhaustion of small vessels to pressures of a few millimeters of mercury. Their operation depends upon the fact that, because of its VISCOSITY, air near a moving stream of water is dragged along with the water.

Mechanical pumps are used extensively for the production of vacua down to 0.001 mm. In the type shown in Fig. 2, the air flows through the inlet into the space in front of the rotating disc and is swept around in front of the disc as it rotates. The pressure built up on the outlet side of the disc opens the outlet valve, permitting the flow of air from the pump.

Mercury-vapor pumps (Fig. 3) work on the principle that if a stream of mercury vapor is forced at high-speed through a chamber containing any gas at low pressures the molecules of that gas which diffuse into the stream of vapor will be driven along by molecular impacts and may be removed from the chamber by an auxiliary pump after the mercury vapor has been condensed. Mechanical pumps, such as are shown in Fig. 2, are used as the auxiliary, or "fore" pumps.

Cooling by LIQUID AIR, prolonged heating to remove occluded gases, absorption by CHARCOAL and the use of "getters" are important factors in the technique of high vacuum production. The "getters"

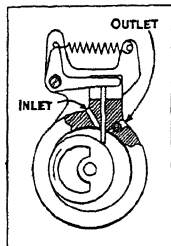


FIG. 2. ECCENTRIC
VACUUM PUMP

used in the manufacture of vacuum tubes are solids which may be volatilized by heat after the tube has been sealed off. The vapor thus produced combines with the last traces of oxygen to form a solid residue.

Measurement of Vacua. Simple, "U"-tube Manometers or mechanical gauges may be used for the measurement of vacua down to about 1 mm. From 1 mm. to 10^{-5} mm., the McLeod gauge is used. Below this range, pressures are usually determined by the use of an IONIZATION gauge. The measurement of pressures as low as those obtainable with the best modern pumps is difficult so that there is some doubt as to the limit of exhaustion which has been attained. It is certainly below one-millionth of a millimeter of mercury. A. A. K.

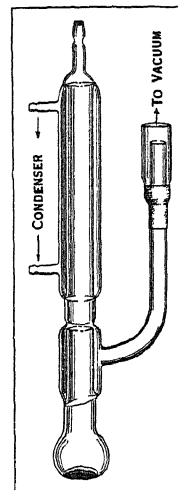
VACUUM BRAKES. *See* BRAKES.

VACUUM CLEANERS. The earliest vacuum cleaners consisted of a metal cylinder 18 inches to two feet in diameter, containing an electric motor, a fan or pump to produce the suction and a bag in which the dirt was deposited. To this cylinder was attached a flexible hose provided with a suitable tool or tools. Expensive and clumsy in operation, this type was rapidly superseded by a portable cleaner in which a fan mounted on a small motor provided the necessary suction or vacuum. In one of the earliest types, revolving brushes helped to loosen embedded dirt and pick up strands of hair or fiber from the carpet. This type, which, with refinements, is in use today, carries a porous, dust retaining cloth bag attached to the handle by which the cleaner mechanism is pushed around. A smaller cleaner, operating on air suction alone, was developed about the same time as the brush type of cleaner, and has remained a common type.

The sales of the vacuum cleaner have, for a number of years, been about 1,000,000 units a year; in January, 1931, there were 9,000,000 in use in the United States.

American vacuum cleaners have been exported to Europe in considerable quantities, and recently a few European vacuum cleaners have been introduced into the United States. Many European cleaners follow the general design of the American product. Some differ in that the bag, as well as the operative mechanism, is enclosed in a metal case forming a small cylinder moved along the floor on polished metal runners.

Among recent refinements of the vacuum cleaner is the paper bag, which after a period of use may be removed and thrown away. It has an advantage over the cloth bag, since it involves less trouble than the periodic emptying of the dust from the cloth container.



COURTESY CENTRAL
SCIENTIFIC CO.

FIG. 3. MERCURY-
VAPOR PUMP

Vacuum cleaners are generally provided with attachments for other uses than cleaning carpets. These attachments are connected to the fan or suction system of the cleaner, and are used for cleaning any surface over which they may be moved.

For larger buildings, vacuum cleaners are usually permanently installed with pipes running from the suction apparatus to numerous conveniently located outlets, into which a rubber hose can be inserted. The other end of the hose can be equipped with many special cleaning tools.

L. E. M.

VACUUM FLASK, a vessel for keeping liquids at an approximately constant temperature. It comprises a double-walled glass container having the space between the walls exhausted to prevent the transfer of heat by CONVECTION. To prevent RADIATION, the glass is silvered, and, to prevent CONDUCTION, the walls are allowed to come together only at the neck. The vacuum flask was invented by SIR JAMES DEWAR and is sometimes known as the *Dewar flask*. When the glass is protected by a metal case, the flask is generally termed a *thermos bottle*.

VACUUM PAN. See EVAPORATION AND EVAPORATORS.

VACUUM PUMP, a pump which exhausts the air from any chamber so as to produce a partial vacuum. See VACUUM.

VACUUM TUBE. See TUBES, ELECTRONIC.

VACUUM TUBE VOLTMETER. Since the amount of CURRENT in the PLATE circuit of an electronic tube (see TUBES, ELECTRONIC) varies with changing potentials placed on the GRID with respect to the FILAMENT, a milliammeter placed so as to read plate current may be calibrated in terms of grid-to-filament potential. The arrangement takes negligible current from the device whose potential difference is being measured, and is applicable for alternating as well as direct-potential measurements.

VACUUM WATER PUMP, a mechanism for elevating liquids by atmospheric pressure. It consists of a closed container, a suction pipe, a steam injection pipe, an outlet and automatic valves. Steam introduced into the chamber condenses, producing a vacuum. With the pressure removed, water is forced into the chamber by the pressure of the air. As the chamber becomes filled, the inlet valve closes and the outlet valve opens. When the liquid has been exhausted the outlet valve closes, the steam inlet valve opens again and the cycle is repeated. Vacuum pumps cannot lift water more than 33 ft., and are inefficient. For pumps used to produce vacua, see VACUUM.

VADE MECUM (literally "go with me"), a memorandum- or pocket-book; a manual or similar article which a person carries with him as a constant companion. In the GARGANTUA AND PANTAGRUEL of Rabelais, the character Panurge calls the leather bottle which he always keeps filled with wine his vade mecum.

VAILIMA, the last home of ROBERT LOUIS STEVENSON, a plain two-story wooden structure situated on

a mountainside above the port of Apia, Upolu Island, Samoa, in the South Pacific. Stevenson moved to Vailima in 1890, and it was there that he wrote his last books. By the natives—among whom he acted almost as a chieftain—he was greatly esteemed, and the story of his attempts to obtain justice for the deposed king, Mataafa, is recorded in his *Footnote to History*, 1892, and in the *Vailima Letters*, 1895. Dying at Vailima, Dec. 3, 1894, Stevenson was buried by six Samoan chieftains on Mt. Vaea, where there is a monument to his memory.

VALDIVIA, PEDRO DE (1500-1554), Spanish soldier and conquistador, born in Villanueva de la Serena. His adventurous spirit led him to America, where he distinguished himself in the conquest of Venezuela. In 1537 he went to Peru, gained Pizarro's confidence, and in 1539 obtained Pizarro's permission to direct an expedition to Chile, where in four months Sancho de la Hoz, joint leader of the expedition, was to follow with provisions. The expedition set out in 1540, following the Arequipa Valley and crossing Maquegua, Tacna and Tarapaca, where de la Hoz joined him. Valdivia immediately imprisoned him, and released him only upon his agreeing to resign his joint commandership and submit to Valdivia. The expedition crossed the desert, reaching Mapocho Valley, where, Feb. 12, 1541, the city of Santiago was founded. Valdivia was named governor of the country. He planted wheat and other cereals, and began the exploitation of the mines.

With reinforcements from Peru, Valdivia founded in 1544 the city of La Serena. He ordered the coasts explored south to 41° lat. Receiving word of the rebellion of Gonzalo Pizarro, he embarked for Peru where he rendered important services to the royalist cause and was named governor of Chile by La Gasca (1548). Charges were preferred against him by his enemies in Chile, but his defense was satisfactory and La Gasca absolved him.

In 1548 he returned to Chile to find that the Indians had destroyed La Serena. He ordered this city restored and continued the conquest to the south, establishing Concepcion in Mar. 1550, and La Imperial in 1551. The next year he pushed on and established the city of Valdivia, Feb. 1552. The same year he sent Francisco de Ulloa and Francisco Cortes Ojea to explore the Straits of Magellan, and, with his lieutenant Villagran continued to strengthen the Spanish towns and forts. In Dec. 1553 in a general uprising of the Indians, led by Lautaro, a former servant of Valdivia, the Spaniards were defeated and Valdivia was captured and killed. He has been compared with Cortes for his perseverance and intrepidity, and superiority of character to most of the other conquistadores.

VALDIVIA, an important city of Chile, capital of the province of the same name, is beautifully situated on the Valdivia River, near Corral, its port. At the mouth of the river dilapidated forts of the Spaniards are found side by side with the modern blast furnaces of a steel foundry. The city is a center for a busy river

traffic and has shipbuilding yards. It has been said that "all the roads of the region are by water." Valdivia has advanced more than any other city of southern Chile due in the main to a large influx of Germans; manufacturing started on the arrival of the first Germans immigrants in 1850. Pop. 1930, 43,296.

VALDOSTA, a city and the county seat of Lowndes Co., situated in southern Georgia about 110 mi. northwest of Jacksonville, Fla. Bus and truck lines and three railroads serve the city. The region produces tobacco, cotton, truck, garden produce and livestock. The principal manufactures are fertilizers and cottonseed and lumber products. In 1929 the factory output reached approximately \$2,000,000; the retail trade amounted to \$6,670,650. There is a United States Government fish hatchery here. Georgia State Woman's College was established here in 1913; there is also a junior college for boys. The city was founded about 1860. Pop. 1920, 10,783; 1930, 13,482.

VALENCE, in chemistry is often described as the power an element possesses of combining with others, and expresses, not the strength of the affinity atoms have for each other, but the number of atoms which can satisfy this desire for combination. The valence of HYDROGEN, the simplest of all chemical elements, is taken as unity, and the valence of every other element, or combined group of elements is expressed as the number of hydrogen atoms which it can combine, or, failing direct union with hydrogen, is estimated indirectly through combination with other elements of known valence. The highest known valence is eight. Several theories concerning the nature of valence have been proposed from time to time, the problem receiving special impetus when, through the discovery of the PERIODIC SYSTEM of the elements, it was found that in general, elements possessing similar chemical properties also had the same valence, but the idea of valence was not capable of being adequately discussed until the formulation of the newest theories on atomic structure (*see* ATOMIC THEORY). It now appears that where an atom consists of a nucleus around which revolves a number of ELECTRONS, arranged in shells, each of which can contain only a definite number or less, the valence is determined by the number and configuration of the electrons in the outermost of these shells. The affinity of elements toward each other is then indicated by the relative configuration of these outermost, incompleated shells, and, upon interacting with each other in forming a compound, it is the electrons in these outer shells which may become a joint possession of the two atoms united. The rare gases, all of which possess only completed shells and no loose electrons, thus exhibit no chemical affinity, and have a valence of zero.

VALENCE, a textile making and wine trading city in southeastern France and capital of the department of the Drôme situated on the Rhône. The city was a center for the Protestants of the neighbor-

hood and suffered greatly by the revocation of the Edict of Nantes. It has a Romanesque cathedral consecrated in 1095 and frequently restored. Pop. 1931, 34,275.

VALENCIA, a city of Spain, capital of the province of that name. A seaport on the Mediterranean, it is also on the Guadalaviar River. A Roman settlement after Visigoth occupation, Valencia became the capital of an independent Moorish kingdom in 1021; it was united to Aragon in the 13th century and to Castile in the 15th. Historically it was a considerable intellectual and artistic center; its university was established about 1411 and a school of painting flourished here in the 16th and 17th centuries. Valencian painting and 15th-century metal-work and sculpture, and a fine octagonal Gothic tower ornament the cathedral which dates from 1262. The silk exchange is also Gothic. Two machicolated gateways of the city wall built on Roman foundations are still in existence. Valencia's chief manufacture is silk. The town also trades in oranges, lemons, olive oil and wine, and metal, leather goods and linen textiles are manufactured. Est. pop. 1929, 272,129.

VALENCIA, a city of Venezuela and capital of the state of Carabobo, situated at an altitude of 1,625 ft., on a lake of the same name. It lies in the region of the Maritime Andes, and has good railroad and steamboat facilities. The streets are wide, and the squares attractive. The chief exports are sugar, coffee and cacao. Valencia was founded in 1555 by Alonzo Diaz Moreno, and was occupied in 1561 by the outlaw Aguirre and his band. It was the capital of the republic for a time. Pop. 1924, 49,523.

VALENCIENNES, an industrial town located in northern France, department of the Nord. Historically a disputed stronghold it passed definitely to France after the wars of the 16th and 17th centuries. Its famous lace industry has died out but it is now the foremost sugar market of northern France, also a center for coal mining and metallurgical industries. It was occupied by the Germans for virtually the duration of the World War. Pop. 1931, 42,359.

VALENTINE, the name of two 3rd-century saints who suffered martyrdom in the year 270, during persecutions under the Emperor Claudius II. One of these saints is said to have been a Roman priest and the other was the bishop of Terni in Italy. The feast day of both is celebrated on Feb. 14. St. Valentine is the name of many other martyrs celebrated in the various Roman martyrologies, but the data on these saints are very obscure. At any rate it is worth noting that the various popular customs connected with St. Valentine's Day seem not to have been derived from the worship of the saint, but apparently have an obscure pagan origin.

VALENTINE, Pope in 827, in the reign of Louis I. the Pious, the son of Charles the Great.

VALENTINIAN I (321-375), Roman Emperor, was born in Pannonia in 321. He became the successor of Jovian as Emperor of Rome in 364 and gave

the eastern part of his realm to his brother Valens. Shortly after the opening of his reign he successfully waged war against German tribes which had tried to extend their influence beyond the Rhine. When the Picts and Scots ravaged the coast of Gaul, he sent his general, Theodosius, against them, and succeeded in crushing the enemy. Again through Theodosius a rebellion of the Moors was suppressed in Africa. When German tribes broke into Pannonia, Valentinian marched against them with a large army, but died suddenly in 375. The Emperor ruled wisely, if somewhat harshly, and was tolerant toward all those who did not hold his own Christian beliefs.

VALENTINIAN II, FLAVIUS (372-392), Roman Emperor, was born in 372, the son of Valentinian I. His half-brother, Gratian, was made emperor in the West in 375, with Valentinian's mother acting as guardian. Gratian's army was conquered and he was killed by Magnus Maximus, in 387, causing Valentinian to flee to Theodosius, emperor of the East. The latter defeated Maximus, and again made Valentinian emperor of the West. Valentinian was murdered by order of Arbogates, one of his generals, in 392.

VALENTINIAN III, PLACIDUS (419-455), Roman Emperor, was born in 419, the son of Constantius III. When only six years old, Theodosius II made him emperor of the West with his mother Placidia as guardian. His armies were defeated in Africa, Spain and Gaul. In 454, jealous of his general Aëtius who had defeated Attila, Valentinian had him assassinated. In 455 Valentinian was murdered.

VALERA Y ALCALÁ GALIANO, JUAN (1824-1905), Spanish writer, was born at Cordova, Oct. 18, 1824. After studying law, he became a diplomat and eventually served as Minister at Washington, Brussels and Vienna. As critic and poet his refinement of style and masterly technique are notable. Valera's fame rests, however, mainly on his novels, which are grounded in native inspiration, yet of universal appeal. Among his best known novels are *Pepita Jiménez*, 1874, *Las ilusiones del Doctos Faustino* and *Doña Luz*. His exquisite style, his irony and subtle humor place Valera among Spain's foremost writers. He died at Madrid Jan. 23, 1905.

VALERIAN (*Valeriana*), a numerous genus of heavy-scented perennials of the valerian family. There are upward of 250 species found chiefly in the temperate and colder parts of the Northern Hemisphere; about 14 species occur in North America. They are mostly smooth herbs or small shrubs with erect stems, strong-smelling roots, entire or pinnately divided leaves and small white or pink, often exceedingly fragrant flowers borne usually in showy clusters. The most important species is the common valerian or garden heliotrope (*V. officinalis*), native to Europe and Asia and widely grown for its fragrant flowers varying from white to lavender and red. The dried rhizome and roots are used chiefly in the form of tincture of valerian or ammoniated tincture of valerian as an antispasmodic and nerve sedative in hysteria and other nerve exci-

tations. Its influence is largely psychological, owing to its strong persistent odor.

VALERIUS FLACCUS, GAIUS (d. c. 90 A.D.), Roman poet, is said to have been born in Setia. He is noted as the author of the *Argonautica*, an epic on the expedition of the Argonauts. The style is ornate and often obscure. The dedication is addressed to Emperor Vespasian. Valerius Flaccus died about 90 A.D.

VALÉRY, PAUL (1871-), French poet and critic, was born at Cette, Hérault, Oct. 30, 1871. He published between 1890-1900 a number of scattered poems, which were collected in 1920 under the title *Album de vers anciens*. From 1900 he wrote nothing until 1917, when the poem *La jeune Parque* appeared. In 1920 Valéry published *Le Cimetière marin* and *Odes*; *Charmes* followed in 1922. His essays, written in a delicate yet profound style, include *Introduction à la méthode de Leonard da Vinci*, 1895, and *Eupalinos, ou l'architecte*, 1923. Valéry's work is obscure from choice, and carries still further the metaphysic lyricism of STÉPHANE MALLARMÉ. In 1925 he was made a member of the French Academy.

VALI, in Scandinavian mythology one of the AESIR and youngest son of ODIN and Frigg.

VALJEAN, JEAN. See JEAN VALJEAN.

VALKYRIE, VALKYRS or **WALKÜRE**, in Scandinavian mythology, the beautiful and fearsome maidens that attended ODIN. They were said to be daughters of princes, or of elves or other unearthly beings. They rode through the air, generally in groups of the multiple of three. BRUNHILD, ODIN's daughter, was one of them. Hovering over the fields of battle, the Valkyrie led away the souls of the dead heroes to Valhalla, where the maidens served at the banquets.

VALLA, LORENZO (1406-57), humanist and critic, was educated in Rome under the humanists Aurispa and Bruni. While teaching rhetoric at Pavia he became involved in a bitter literary quarrel with members of the Law Faculty and resigned. After an interval spent in travel he became private secretary to King Alfonso of Naples but spent most of his time quarreling with other humanists at the Neapolitan court. Leaving Naples for Rome he was appointed Papal Secretary by Nicholas V, the first of the humanist popes. Valla was preeminent as a critic in the fields of literature, history and religion. His most famous work was an exposure of the forged *Donation of Constantine*. While not the first to attack its authenticity, Valla's unrivaled knowledge of classical literature and history enabled him to point out the numerous verbal anachronisms and historical errors. Although a humanist, he dared criticise Livy. He regarded Moses and the evangelists as mere historians and cast doubts on the authenticity of the Apostles' Creed. Erasmus later made use of his *Notes on the New Testament*. He satirized monasticism and current philosophies in many amusing dialogues.

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VALLADOLID, Mexico. *See* MORELIA.

VALLADOLID, a city of Spain, capital of the province of the same name, and seat of an archbishop. Noteworthy features are the Plaza Mayor with its arcades, the cathedral begun in 1585, the medieval Gothic Church of Santa Maria la Antigua, the former Dominican cloister and former royal palace. Besides the university, there are many other educational institutions. The industrial enterprises include railroad shops, foundries and mills. The chief products are paper, woven goods, leather, hats, filigree work, wine and chocolate. The city was the capital of Spain for a long period during the Middle Ages. Est. pop. 1929, 79,076.

VALLANDIGHAM, CLEMENT LAIRD (1820-71), American political figure, was born at New Lisbon, O., July 29, 1820. He attended Jefferson College (Pa.), and in 1840 moved to New Lisbon, O., where he studied law and was admitted to practice in 1842 at Dayton. At 25 he was elected to the Ohio Legislature as a Democrat, and in 1856 was elected to the House of Representatives where he served until 1863. He opposed the Civil War as "cruel and unnecessary" and his defiance and constant abuse of the Lincoln Administration made him a conspicuous figure. He was defeated for reelection in 1862. After his term in Congress expired he continued to denounce the war. Wide approval of Vallandigham's opinions had by this time rendered him a dangerous enemy of Union success and following a particularly violent denunciation of the government he was arrested. A military commission sentenced him to close confinement, which Lincoln commuted to banishment in order to avoid attaching martyrdom to his punishment. Vallandigham was permitted to pass the Confederate lines, but grew dissatisfied with his reception in the South and went to live at Halifax, N.S. While out of the country he was, in 1863, nominated for Democratic governor of Ohio, and was defeated by a 100,000 majority. He returned to Ohio in 1864, and was killed accidentally during a trial at Dayton, June 17, 1871.

VALLEJO, a port city in Solano Co., in western California, situated on San Pablo Bay at the mouth of the Napa River, 22 mi. northeast of San Francisco. The Southern Pacific Railroad, San Francisco Bay steamers, ocean freighters and airports serve the city. Dairying, stock-raising and grain-growing are the leading interests of the countryside. Quicksilver is found in the vicinity. The city has flour mills, clothing and dairy products factories. The manufactured output is worth about \$22,000,000 annually. The retail business for 1929 amounted to \$9,054,870. The Pacific Squadron of the U. S. Navy has headquarters at Mare Island opposite the city. Vallejo is the largest port on the Napa River which had 183,229 tons of traffic worth \$6,330,317 in 1929. Vallejo was founded in 1850, and from 1851 to 1853 was the capital of the state. It was incorporated in 1868. Pop. 1920, 16,845; 1930, 14,476.

VALLEY, an extensive depression in the surface of the land, in general elongate in form, through a

channel in which a river or lesser stream of water usually flows. In its widest meaning a valley embraces the entire drainage basin of a river system, as, for example, the Nile valley or the Mississippi valley. Erosion of the rocks and soil is the principal factor in the formation of a valley, which is produced both by the weathering of its sides and the cutting or deepening of its channel. Valleys, especially those of major streams, serve as natural arteries of communication, and, when containing large areas of fertile soil, they yield sustenance for dense populations, as those of the Hwang, the Ganges, the Nile and the Mississippi. *See also* ALLUVIUM; EROSION; FLOOD PLAIN; RIVER.

VALLEY CITY, a city in southeastern North Dakota, the county seat of Barnes Co., situated on the Sheyenne River, 58 mi. west of Fargo. It is served by two transcontinental railroads. There is an airport. The city has flour mills. A Teachers College is located here. Valley City was settled in 1872. Pop. 1920, 4,686; 1930, 5,268.

VALLEYFIELD, a town and port of entry of Beauharnois Co., Quebec, Canada, situated at the northeastern extremity of Lake St. Francis, an expansion of the St. Lawrence River 25 mi. southwest of Montreal. A port of call of Montreal and Lake Ontario steamers, it is an industrial town given over to flour, puce silk, cotton, paper mills and canneries. Valleyfield is the seat of a Roman Catholic bishopric. The inhabitants are predominantly French-Canadian. Pop. 1921, 9,215; 1931, 11,411.

VALLEY FORGE, a village beautifully situated on the Schuylkill River in eastern Pennsylvania about 20 mi. northwest of Philadelphia. The village and its vicinity are famous as the scene of the tragic winter of 1777-78 when Washington and his 11,000 "ragged continentals" endured privation and hardship within a short distance from the wealthy Tory city of Philadelphia. An area of about 1,500 acres has been set aside by Pennsylvania as the Valley Forge Memorial Park. It includes the old stone house used by Washington as his headquarters and the camp site of the army. The Valley Forge Memorial Chapel is of architectural interest. It is admired for its stained glass windows which depict historical and patriotic themes. Pop. 1930, 300.

VALLEY STREAM, a village and residential suburb of New York City, situated in Nassau Co., western Long Island, N.Y., 17 mi. east of Brooklyn. It is served by the Long Island Railroad. The Curtis Airport is located here. Truck farming is the leading interest of the countryside. The retail business in 1929 amounted to \$5,331,216. Valley Stream was incorporated in 1925. Pop. 1930, 11,790.

VALLOMBROSA, a mountain summer resort in Tuscany, central Italy, situated in the Pratomagno Range, 22 mi. southeast of FLORENCE. Vallombrosa is noted for its magnificent pine forests and its view of the Arno valley. The monastery of Vallombrosa, founded in the 11th century (*see* VALLOMBROSIANS), is occupied by the Royal Forestry Institute. Above Val-

Iombrosa is the former Benedictine monastery, known as *Il Paradisino*.

VALLOMBROSIA (Latin *vallis*, valley, and *umbrosa*, shady), monks of a Benedictine congregation founded about 1038 at Vallombrosa near Florence, by St. John Gualbert, a monk of Camaldoli. Great austerities retarded its development until modifications were made. By 1198, however, more than 60 monasteries were flourishing in Italy, Sardinia and France. Incessant warfare in Italy reduced the order during the 18th and 19th centuries; it now has eight monasteries, three convents for women, and a total membership of approximately 200, all in Italy. Galileo once studied at Vallombrosa, which had an observatory, erected in 1564. Lay brothers were introduced to the conventual system largely through the Vallombrosians.

VALMY, BATTLE OF, an important engagement, fought Sept. 20, 1792, in the first phase of the war of the European Powers against the French Revolution, between the French under Dumouriez and the Prussians under the Duke of Brunswick. The latter carried on an artillery bombardment for several days, but, unable to advance, retreated on the 10th day. The effect of the success at Valmy on the French people was notable in that it relieved them from their horror of foreign encroachment.

VALOIS, HOUSE OF, a cadet branch of the celebrated Capetian dynasty, which reigned in France from 1328 to 1589. The house descends from Charles, a son of Philip III. The reigning branches of the Valois house were the direct line, which ruled during 1328-1498, starting with Philip VI; the Orleans branch, which supplied occupants for the French throne during 1498-1515, beginning with Louis, duke of Orleans, son of Charles V; and the Angoulême line, rulers during 1516-1589, whose kings were descendants of John, also a son of the same duke of Orleans. The two and a half centuries of Valois rule represent a period of disaster and turmoil for France, whose people were heavily taxed for the private and public excesses of their rulers. The most important historically of the seven Valois kings were Charles V (1364-80), Louis XI (1461-83), Francis I (1515-47) and Henry III (1574-89). See FRANCE, HISTORY OF.

VALONA, a port of ALBANIA, located close to the Gulf of Valona. Enclosed by mountains, groves of olive trees and gardens, with a palace and minarets, the town is picturesquely built on a hill. Held by Normans and Byzantines, in 1464 Valona became a Turkish possession. The Venetians occupied it in 1690 but relinquished it to the Turks a year later. During the Balkan War in 1912 the Greek fleet bombarded it. Valona and its port were captured by the Italians at the beginning of the World War and were released only in 1920. More than half of the inhabitants were Moslem in 1924. Olives, cotton, sheep and grain from the nearby agricultural regions are brought to Valona for export. Acorns from the oak trees of the district furnish a substance that has

been named *Valonia* after the city. This is employed in the process of tanning. The city has an oil refinery, sawmills and repair shops. Pop. 1930, 9,100.

VALPARAISO, the chief port of Chile, situated on a good harbor of the Pacific coast, 116 mi. northwest of Santiago. It is the most important Pacific port south of Panama. The semicircular bay, surrounded by sloping hills, has a great depth and is for this reason open to the north without protection. A breakwater 990 meters long has been built to protect the piers from danger from north winds. An excellent motor road links Valparaiso and Santiago; it does not go through the hills as does the railroad.

The business section of the city lies on a narrow strip of shore between the bay and the amphitheater of hills, the level sector varying in width from two blocks to half a mile. Most of the residential district is situated on the slopes and hill tops. The business section, largely destroyed by earthquake in 1906, has been rebuilt in a more substantial manner. Ascensors, run by cable on inclined planes, are in general use for the ascent of the bluffs, although paths and a few roads wind steeply upward in the cañons which in places separate the hills. Some of these rise to a height of 1,000 ft. The suburb of VIÑA DEL MAR is a fashionable summer resort with a fine beach. The Industrial University of Valparaiso was opened in 1921. Valparaiso was named by Juan de Saavedra in 1536 from his native village of Spain. The English corsair, Sir Francis Drake, took the settlement in 1578. Pop. 1930, 193,205.

VALPARAISO, a city in northwestern Indiana, the county seat of Porter Co., situated 44 mi. southeast of Chicago. It is served by bus lines and three railroads. The city is surrounded by beautiful farming country, producing corn, oats, fruit, and dairy products. Valparaiso has factories making chiefly magnets and electrical appliances. It is the seat of Valparaiso University. The city was founded about 1835 and incorporated in 1865. Indiana Dunes State Park is 15 mi. north. Pop. 1920, 6,518; 1930, 8,079.

VALPARAISO UNIVERSITY at Valparaiso, Ind., a coeducational institution organized in 1859 as Valparaiso Male and Female College (Methodist). Its benefactor, Henry B. Brown, planned the institution for students who did not find the regular college courses available. The university is in session throughout the year and students may enter at any time. Since 1925 it has been operated by the Evangelical Lutheran Synodical Conference of North America. The productive funds in 1931 amounted to \$442,480. The library contained 26,673 volumes. In 1931-32 there were 582 students enrolled, and a faculty of 49 headed by Pres. O. C. Krienheder.

VALUATION ENGINEERING, the scientific determination of the value of properties. This is needed when purchasing or selling are contemplated; also for taxation purposes and for ascertaining, by comparison with earlier valuations, the rate at which value is lost, in order that current depreciation may be properly taken into account as an element of operat-

ing expense. Valuations are also needed in every determination of a rate base, when the earnings of a public utility are to be legally regulated. Practically all major engineering projects involve the application of valuation. The engineer must present to his client the economic as well as the engineering aspects of the project in contemplation. Market value is measured by a monetary unit such as the dollar, the pound, the franc, the mark, and the like. In all, except cases of recent construction, if cost be called to aid in making an appraisal, careful consideration must be given to the constantly changing value of the monetary unit. Thus, for example, two and one-half gold dollars were required after the World War to purchase as much food, clothing, shelter, transportation, recreation, education and the like, as could be purchased for one dollar before the war. A house which cost \$5,000 to build in 1913 would have cost about \$12,500 in 1919. Its value in exchange would have been estimated at \$5,000 in 1913 and at \$12,500, less depreciation, in 1919.

The time element is, then, a factor to be taken into account in making appraisals, both because the dollar is a variable and not a fixed standard of value, and because properties which have a limited life of usefulness lose value with age. The present, or remaining value of buildings, machinery, and the like is, therefore, the present day cost of reproduction less depreciation.

The following factors determine present value: present day cost of construction; probable expectancy of life when new; interest rate at which money is available and the probable remaining years of usefulness. The last factor indicates the present condition, and is ascertained by inspection. Age may not affect the value which is left. Many pieces of machinery, many buildings, outlive their originally predicted term of usefulness. An old item sometimes has an expectancy as great as when new. To determine remaining value, the probable remaining life is compared with original expectancy. It is not proper to bring it into comparison with age plus probable remaining life. Remaining value is then computed by the SINKING FUND method. C. E. G.

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VALUE, GENERAL THEORIES OF, in philosophy, the study of value; the attempts to define it or to indicate its place in the universe. One theory, instead of attempting to define it, holds that value is essentially indefinable. Thus good is regarded as a simple predicate too elementary to be defined. It is a quality like red or yellow. Such a statement as "Pleasure is the good" does not define goodness. It points to things that are good but does not touch goodness as such. A variation of this view is found in the one which holds that value can be defined only in terms of better and worse, these in turn being indefinable notions.

Value has sometimes been located in the universal-ity embodied in anything. A thing is good to the

extent that it realizes its kind, that is, contains its own universal. Perfection, or complete self-realization, becomes the criterion for value. But to a certain extent it may be said that everything is good of its kind. Even a rotten orange might be good of its kind. It would be a good rotten orange, a perfect specimen of rottenness applied to oranges. The distinction is often made between extrinsic and intrinsic value. The two are not mutually exclusive, for if we start with the one there is a tendency to work over to the other. Extrinsic value is instrumental. A thing is good only as it is good for something. Yet we do not say that it is really good unless it is good for something that is good. Hence the intrinsic value is presupposed in the theory of good as "good for." On the other hand, when we say a thing is good and are asked why, we at once try to show that it produces good consequences, that is, it is good for something. The instrumental theory is here presupposed.

Value may be located in unity. This sets up the ideal of the whole, which would measure the worth of a thing by the degree in which it reflects the whole of reality. Partialness and incompleteness are here signs of a lacking in value. In criticism it may be said that unity is a value is one thing, but that value consists in unity is quite another. Like existence it may be a value, but do value and existence coincide, or is existence even a criterion for value? Value may also be regarded as a function of interest. Interest is here regarded as something objective. There are various forms of this theory. The interest itself may be qualified, the object of interest may be qualified, or the value may be located in interest as such independent of such qualifications. A variation of this theory locates it in the judging process itself.

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VALUE, THEORY OF, in economic theory, a fundamental concept closely associated with the allied concept utility or value in use as applied to commodities. The terms total utility and marginal utility are used to cover the varying degrees of value that the same commodity can possess under varying conditions; and the laws of SUPPLY AND DEMAND as well as the laws of diminishing utility tend to express in economic terms the conditions upon which value depends. The COST OF PRODUCTION as well as a possible monopoly element are of course other factors entering into the determination of economic values. The profits of producers being generally an additional element in the consideration of values, it is necessary also to consider the limiting influences to which these products are subjected. Under conditions of free competition the prices of commodities tend to fall to the level of actual cost of production. The Austrian school of economists, followed by W. S. JEVONS of England and others, have maintained that value is entirely dependent on utility. This school is in opposition to those who would make the LABOR expended in production the determining factor in the

determination of value. The Marxian school (see K. MARX), for instance, adopts the theory that the value of an object lies in the fact that the commodity is the embodiment of a determinate quantity of socially necessary labor-time, and that the capitalist obtains his profits by appropriating the surplus value created through lower WAGES and longer hours than would otherwise be necessary. The theory of value includes the concept of the stability of value of MONEY and of commodities expressed in terms of money, a status that is precisely measured and calculated by means of so-called INDEX NUMBERS. The term standard of value, is used to define a measure that can express all values in terms of one. See also ASSESSED VALUE.

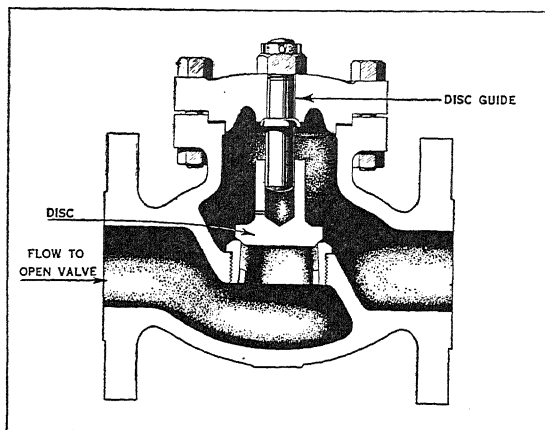
VALVES, devices for controlling the flow of liquids and gases. Valves are made in many different types, both in respect to operation and construction. They vary in size from the small "check" valve in a bicycle tire to gigantic steam, hydraulic or electrically operated valves which control the input to large water turbines (see TURBINES, WATER) in HYDRO-ELECTRIC POWER plants.

Valves fall into the following general classifications: rotary, slide, poppet, check, gate, globe and butterfly. *Rotary* valves turn or rotate in opening and closing, the simplest form being the "plug cock." This consists of a drilled plug fitted into a section of pipe. When the plug is in a certain position, the hole is in line with the opening in the pipe, and the valve is open. When a quarter turn from that position the hole is perpendicular to the opening of the pipe and the valve is closed. In a three-way plug cock there is a second hole perpendicular to the first and terminating at it to form a "T." This type is used in a "T" connection. Rotary valves of special design are sometimes used to admit fuel to STEAM ENGINES and INTERNAL COMBUSTION ENGINES.

Slide valves are those that slide from one position to another to close or open a passage. The slide valve is commonly used for controlling the intake and exhaust in a steam engine. A "D"-shaped slide valve, long used in steam engines, with double-acting pistons, admits steam to first one end of the cylinder then the other, with the exhaust taking place through the center of the "D" as its sides cover and uncover the valve ports in the proper sequence. Another special type of slide valve is the *Needle* valve. Its seat is long and tapered so that the area of the opening is varied slightly as the needle moves in or out. It is used largely in high pressure work and where it is necessary to have fine adjustments, as in spraying fuel into the cylinders of a Diesel or OIL ENGINE. *Sleeve* valves, used in the automobile engine, are still another type of slide valve.

Poppet valves are employed in a great many mechanisms, their widest use being in internal combustion engines to control intake and exhaust. They consist of a disc-like head of a conical or mushroom shape mounted on a stem, and they are opened by a cam and closed by a compression spring, or vice versa.

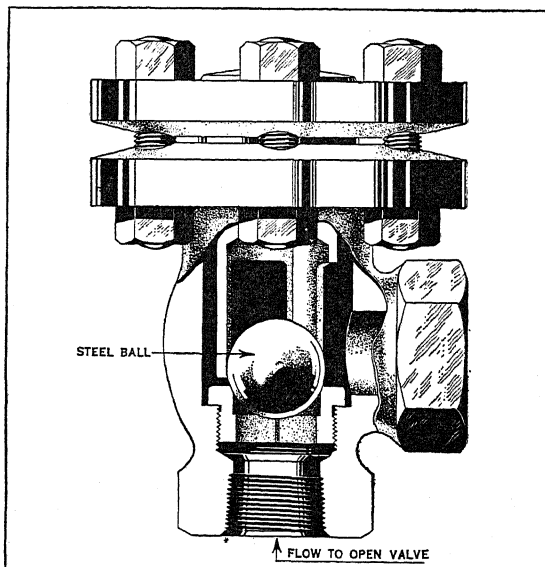
Check valves are of various designs but all operate on the principle of opening automatically with pressure in one direction and closing with pressure in the opposite direction. They are employed in pumps



COURTESY EDWARD VALVE & MFG. CO.

DISC TYPE CHECK VALVE

and compressors to permit the flow of fluid in one direction only. The *Flap* valve, comprising a disc-like element pivoted on one side, is a common type of check valve. A metal ball which seats itself with pressure in one direction and lifts from the seat with the opposite pressure is also a common type. Poppet valves are sometimes used as check valves.

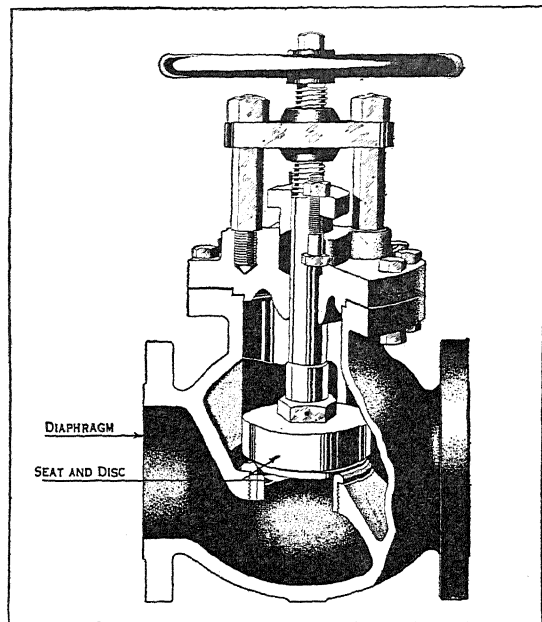


COURTESY EDWARD VALVE & MFG. CO.

BALL TYPE CHECK VALVE

Globe valves have a diagonal partition so formed as to have a section parallel to the axis of the pipe in which are an opening and a valve seat. A disc-like valve element with beveled edges and attached to a threaded stem may be screwed up or down by turning a hand wheel to open or close the opening.

The *Gate* valve is similar to the globe valve but in it the fluid does not follow such a circuitous route. It has no partition and consists of a slightly wedge-shaped valve element which fits between two seats slightly inclined to the axis of the pipe. A recently developed variation of the gate valve has a rotating sphere with a hole through it as the valve element.



COURTESY EDWARD VALVE & MFG. CO.

GLOBE VALVE

The *SAFETY VALVE* is a special type of valve designed to open against a predetermined pressure to protect a boiler or compressor from dangerous pressures.

Butterfly valves are, essentially, discs having two co-axial hubs on which they may be turned so that they are parallel or perpendicular to the axis of the pipe, or in any position between these extremes. This type of valve, often several feet in diameter, is frequently used in regulating the flow of large volumes of water.

VAMPIRE, in folklore, a ghost or spirit of one who has died who sucks the blood of a sleeping person. The victim may in turn become a vampire. The power of a vampire may be destroyed only by driving a stake through its heart when the spirit returns to the corpse. See also **VAMPIRE-BAT**; **WITCHCRAFT**.

VAMPIRE-BAT, a name loosely applied to various harmless tropical bats, suggested by a fancied resemblance to the spectral beings of superstition and folklore. Properly the name should be restricted to a single family (*Desmodontidae*) of small, leaf-nosed species, confined to tropical America, which live on the blood of animals, including man. These bats are fitted with projecting upper incisors and lancet-like canine teeth, with which they are able at night to puncture the skin of the victim, rarely awakening it; and the lips and tongue are especially fitted for suck-

ing the blood. They abound in the American tropics, but seem irregularly distributed, some districts being nearly free of them, while in others the rearing of horses and cattle is made difficult because of their persecutions. Men sleeping uncovered are often attacked, and may sometimes lose so much blood in a night as to be weakened. See **VAMPIRE**. E. I.

VAN, the largest lake in Asiatic Turkey, occupying an irregular triangular space 80 mi. by 30, about 5,260 ft. above sea level, on the borderland between the Armenian and Kurdistan highlands. The lake is renowned alike for its romantic beauty and historic associations. From the snowy Sipan-dagh towering above its northern shore, it is seen to occupy the center of a magnificent valley, surrounded on three sides by mountains whose forests of firs, chestnut, beech, walnut and ash formerly merged in the broad belt of gardens and melon grounds that fringe most of the shore line. But now the mountains have been almost denuded of trees. The waters of the Van, which teem with fish and have several lovely islets, are very salty, with no present outflow. The town of Van, about a mile from the lake, was the capital of the Vannic kingdom of the Assyrian period.

VANADINITE, an ORE of vanadium and minor source of lead, important in a few districts only. It is ruby red to yellow or brown in color, and translucent to opaque. Chemically, it is the chloro-vanadate of lead, crystallizing in the **HEXAGONAL SYSTEM**. It is usually found in the oxidized portions of veins containing lead, copper and other vanadium minerals, as in Arizona, New Mexico and Mexico. Vanadium is used for toughening steels, and its salts are employed in paints, dyes and medicines. See also **ORE DEPOSITS**.

VANADIUM, a chemical element (symbol V), belonging to the fifth group in the **PERIODIC SYSTEM**, is a grayish-white ductile metal capable of being worked and drawn into wire in the cold. Its atomic weight is 50.95, density 6, and melting point about 1720° C. It is remarkably non-volatile at its melting point and is extremely difficult of reduction to metal.

Vanadium occurs in its salts in five different states of valency. A very large number of vanadium compounds are formed where it functions as the base. Its oxides function as acids giving rise to many vanadates. It also forms a considerable number of organo-metallic compounds.

Vanadium has only been very recently reduced to the pure metal by the action of metallic calcium on its oxide. Commercially no pure metal is produced but large quantities of ferro-vanadium are manufactured. The main source of vanadium mineral is the Peruvian deposit of the sulphide patronite. The ore is smelted directly in electric furnaces with coke, flux, and iron scrap, producing a ferro-alloy containing from 35% to 40% vanadium. In the manufacture of vanadium pentoxide the ore is roasted with alkali and extracted with water. From the sodium vanadate solution, the vanadium pentoxide is precipitated by addition of sulphuric acid. For manufacture of ferro-

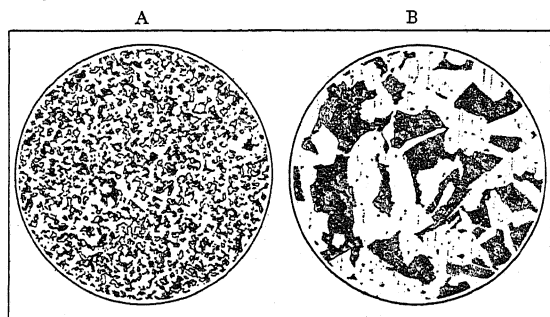
vanadium alloys free from carbon the pentoxide is reduced in shaft furnaces or crucibles by the aluminothermic process.

Vanadium has its greatest commercial use as an alloying agent in steel (*see* IRON; VANADIUM STEEL), refining its grain-structure and imparting to it resistance not only to tensile but also to dynamic stresses. Vanadium pentoxide is used as an oxidizing catalyst (*see* CATALYSTS), especially in the manufacture of sulphuric acid, in place of the hitherto used platinum. Vanadium salts are used in dyeing, the varnish and linoleum industries, glass, photography, therapeutics and in biochemical work. B. D. S.

BIBLIOGRAPHY.—J. W. Mellor, *Treatise on Inorganic and Theoretical Chemistry*, 1929.

VANADIUM STEEL. Vanadium is used in small quantities, from 0.12 to 0.25%, in structural steels. However, in tool steels a content of over 2% has been used. It is used not only by itself but also in conjunction with other alloying elements, such as silicon, manganese, chromium, nickel and molybdenum. Vanadium steels of various types are used in the rolled, forged, or cast state in the transportation industries, for railroad, automotive and aeronautical work. They are also used in the chemical industry where high pressures at ordinary or elevated temperatures are encountered and where resistance to gas penetration or certain forms of chemical attack is required.

The present day engineering demands on steel require material withstanding not only static loads but dynamic stresses, together with shock and impact. For such purposes vanadium steels are preëminently suitable. Vanadium next to carbon is the most potentially influential element used in steel. It exerts



COURTESY VANADIUM CORP. OF AMERICA

MICROSCOPIC PHOTOGRAPHS OF (A) VANADIUM STEEL CASTING AND (B) ORDINARY CARBON STEEL CASTING

a very marked persistent grain refining influence on the micro-structure of steel, eliminating dendritic segregation and Widmanstaettan structure. Vanadium retards the growth and decomposition at elevated temperatures of carbide particles. Due to these influences it not only improves the physical properties of steel but allows uniform attainment of these properties and response to heat treatment in commercial steels. *See also* VANADIUM; STRUCTURAL STEELS; TOOL STEELS. B. D. S.

BIBLIOGRAPHY.—*National Metals Handbook*, American Society for Steel Treating, 1930; G. L. Norris, *Vanadium*.

VANBRUGH, SIR JOHN (1664-1726), English dramatist and architect, was baptized in London, Jan. 1664, and began his career in the British army. In 1695 he was appointed architectural commissioner to Greenwich Hospital, and in 1697 produced *The Relapse* at Drury Lane. Its great success brought forth *The Provoked Wife*, 1698, and *Æsop*, the same year. Vanbrugh, however, from this time turned his attention more to architecture, and his adaptation, *The Pilgrim*, 1700, and *A False Friend*, 1702, are inferior to his other plays. He built Castle Howard and Duncomb Hall in Yorkshire, Eastbury in Dorsetshire, Oulton Hall in Cheshire, etc. His building of Blenheim brought him a great deal of distress, and his own theater in which his play, *The Confederacy*, appeared, was a complete failure due to bad acoustics. In 1714, George I on his accession bestowed a knighthood upon him. He died in London, Mar. 26, 1726.

VAN BUREN, MARTIN (1782-1862), eighth President of the United States, was born at Kinderhook, N.Y., Dec. 5, 1782. His father, Abraham Van Buren, a farmer and inn-keeper, and his mother, Maria Hoes Van Buren, were of Dutch descent and members of the Dutch Reformed Church. Martin as a boy attended the common schools and Kinderhook Academy. He studied law at Kinderhook and in New York City where he was admitted to the bar in 1803. He began practice in Kinderhook where he gained legal renown and earned a substantial income.

Early Career. Van Buren combined legal with political activities. New York state at the time was torn by factions and partisan quarrels. The Federalists opposed the Republicans, and the latter were divided into factions who occasionally coalesced with the Federalists. Van Buren associated himself with the followers of George Clinton. He was surrogate of his native Columbia Co., 1808-13. He served in the state senate 1812-20 and from 1815-19 he was also the state attorney-general. In the senate he expressed himself in sympathy with the War of 1812 and in 1817 he supported De Witt Clinton's proposed plan for the Erie Canal.

Van Buren moved from Kinderhook to Hudson in 1808, and from there to Albany in 1816. He was a prominent figure in the dominant political group of his state known as the "Albany Regency" which became famous for its political intrigues and the use of its political control for the benefit of its adherents. In 1821 Van Buren was elected to the United States Senate. At first an advocate of internal improvements at national expense and of a protective tariff, he later opposed them. In the presidential election of 1824, which was contested by John Quincy Adams, Andrew Jackson, Henry Clay and William H. Crawford of Georgia, he supported the last-named. When the task of choosing the president was thrust into Congress because of the absence of a majority, Van Buren tried to unite the forces of Crawford and Jackson. It was the beginning of

a close personal and political friendship between Van Buren and Jackson which was of value to both.

Van Buren in the Senate opposed Adams' plans for internal improvements and adopted a captious and almost perverse attitude of opposition toward the proposed United States participation in the Panama Congress. He was reelected to the Senate in 1827, during which year he toured several southern states in the interest of Jackson, incidentally gaining for Jackson the important support of Crawford and his followers. He resigned from the Senate to assume the duties of governor of New York on Jan. 1, 1829 to which office he had been elected the preceding year, and in turn resigned that office to become Secretary of State in Jackson's cabinet, Mar. 5, 1829. Van Buren tactfully avoided any difficulties with Jackson's advisers who were popularly known as the "Kitchen Cabinet."

A widower, and with only male children, Van Buren endeared himself to Jackson by courteously recognizing socially Mrs. John Eaton, the wife of the Secretary of War, who was ostracized by many of the wives of government dignitaries. He sided with Jackson in the bank controversy and in Apr. 1831 he resigned from the cabinet as an example to the other members in order that Jackson might reorganize his cabinet with a view to the elimination of Calhoun supporters. Jackson had quarreled with Calhoun, the vice-president, and before Van Buren's resignation, Jackson had indicated his desire that Van Buren should be the vice-presidential nominee in 1832. He was appointed minister to Great Britain in August, 1831 and after his arrival in that country the Senate refused to confirm the appointment by the casting vote of Calhoun, vice-president.

Van Buren toured the continent in the spring of 1832 and returned to America in July, 1832 after the first Democratic national convention had nominated him for the vice-presidency on the ticket with Jackson. After his election Van Buren experienced the satisfaction of presiding over the Senate which had rejected his appointment as minister to Great Britain. He was the successful presidential candidate of the Democratic party in 1836, mainly through the friendly influence of Jackson, and he was elected in opposition to three anti-Jackson candidates, Hugh L. White, Daniel Webster and William Henry Harrison. He was inaugurated Mar. 4, 1837.

Administration. Van Buren had been in office but a short period when the nation experienced, beginning in 1837 and continuing for several years, one of the severest panics and economic depressions in its history. It has been estimated that 90% of eastern factories closed, by the end of the summer of 1837 not a bank in the country was redeeming its currency by specie, unemployment was widespread and bad crops accentuated the distress. The depression was world-wide and the result of complex, interrelated forces which had been developing for years, but the nation directed its resentment against Van Buren and the previous Democratic Jacksonian ad-

ministration which had weakened public confidence in paper money, had issued the demoralizing Specie Circular (1836) and had prevented a re-charter of the Bank. Van Buren called a special session of Congress in Sept. 1837 which authorized the issue of treasury notes to meet governmental expenses.

The President continued his opposition to a U.S. Bank charter, and realizing the evil of continuing the use of the "pet banks" for governmental deposits, he offered a plan for an independent treasury or a subtreasury which would dissociate completely government funds from banks. The proposal met with strong opposition and was not finally passed until June 30, 1840. Disorder and petty warfare broke out along the border of Canada in 1837, which was in a mild revolt against English rule at the time. Van Buren vigorously enforced American neutrality in the affected areas of the northeastern United States and for his policy was accused of timidly submitting to British domination.

Later Life. In 1840 Van Buren was again the nominee of the Democratic party but was defeated by William H. Harrison in a turbulent, colorful campaign which was replete with the paraphernalia of political carnival. He retired to his estate at Kinderhook, N.Y. and failed to obtain the expected nomination of 1844. He had a majority of the delegates but his opposition to Texan annexation prevented his procurement of the necessary two-thirds vote. In 1848 he was the presidential nominee of the "Barnburner" faction of New York Democrats who favored the Wilmot Proviso, and also of the new Free Soil Party. The principal result of his candidacy was to split the Democratic vote in New York state, thereby assuring the Whig Taylor's election as a reversal of result in that state would have reversed the vote in the nation. Van Buren remained in private life until his death at Kinderhook, July 24, 1862. In 1807 he married Hannah Hoes (d. 1819), the mother of his four sons. S. McK.

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VAN BUREN, a city and the county seat of Crawford Co. in northwestern Arkansas, situated on the Arkansas River, opposite Fort Smith. Bus lines and two railroads serve the city. Cotton and corn are the chief crops of the district. Gas fields are nearby. The industries of the city include shipping, particularly agricultural products, and manufacturing bricks, tiles and coal cars. Van Buren was founded in 1817 and incorporated in 1920. Population 1920, 5,224; 1930, 5,182.

VANCOUVER, GEORGE (1758-98), English navigator and explorer. He sailed with James Cook on his 2nd and 3rd voyages, following which he was stationed at the West Indies. In 1791, Vancouver was given command of the ship *Discovery* and ordered to explore the northwest coast of North America. He sailed from England, then via Cape of Good Hope to Australia, New Zealand, Hawaii and to California, here following the coast north even-

tually sailing around the island that is now called Vancouver Island. Returning to England in 1795 he published *A Voyage of Discovery to the North Pacific Ocean and Round the World in the Years 1790-95*. Vancouver died in Petersham, May 10, 1798.

VANCOUVER, the largest city of British Columbia, Canada, and one of the chief seaports on the Pacific coast of America. The city has an extensive harbor, open all year, on the southwest extremity of the mainland on the shore of Burrard Inlet. Across the inlet are to be seen the two mountain peaks known as the Lions. To the north rise the Coast Range Mountains, and to the southwest Mt. Baker is visible. Stanley Park, with fine pathways and drives has a forest area of about 1,000 acres. The Marine Drive covers 2, mi., most of which lies close to the sea. The University of British Columbia and Provincial Normal School are located in Vancouver.

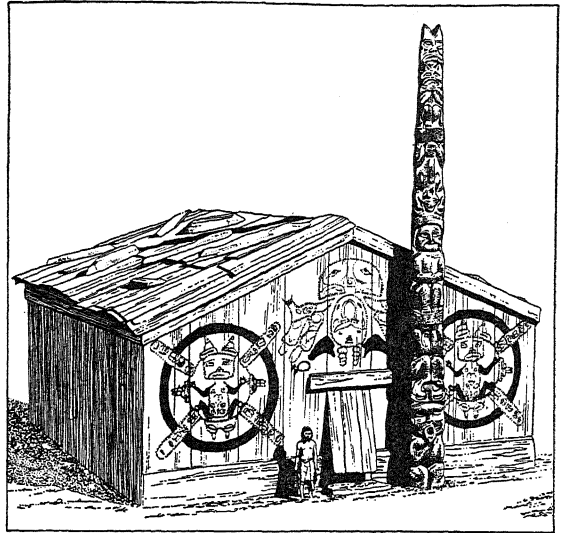
Vancouver is the principal manufacturing center in the province, the chief activities of its numerous industrial plants being connected with lumbering, mining, fish and fruit canning and shipbuilding. Since the opening of the Panama Canal the city has rapidly developed as a grain port. The shipments in 1919 were about 250,000 bu., in 1921 over a million bushels went to Europe and the Orient, and beginning with 1925 crop-year shipments have exceeded 50,000,000 bu. Mail steamers run to Honolulu, Japan, China and Australasia. The city is the western terminus of the Canadian Pacific and Canadian National railways.

In 1886 the site of Vancouver was a village of huts named Granville. In that year it was incorporated as a city with a population of 600 and given its present name in honor of Captain GEORGE VANCOUVER, who explored the coast about 100 years before. Pop. 1921, 163,220; 1931, 246,593.

VANCOUVER, the largest port city on the Columbia River, and the county seat of Clark Co., southwestern Washington, situated 8 mi. north of Portland, Ore. It is served by steamers, bus lines, airplanes and four railroads. Vancouver is a market and shipping point for fruit, nuts, dairy products and farm crops, and especially for lumber and lumber products, including paper and paper bags. The total traffic of the harbor, 1930, amounted to 420,524 tons, worth \$4,166,239. The local manufactures are chiefly lumber, paper, canned fruits and fish, dairy products and linen. The industrial payroll, 1929, amounted to \$7,495,772. In 1929 the value of the factory output was about \$13,000,000; the retail trade was worth \$9,167,568. Vancouver was a trading post, established in 1825, of the Hudson's Bay Co. Vancouver Barracks, one of the oldest and most historic army posts on the Pacific coast, is located on 640 acres in the heart of the city. Vancouver was incorporated in 1857. Pop. 1920, 12,637; 1930, 15,766.

VANCOUVER ISLAND, a district of British Columbia, Canada, divided from the mainland by Queen Charlotte Sound and the Strait of Georgia. The Strait of Juan de Fuca touches it on the south

and the Pacific Ocean bounds it on the west. It is 285 mi. long, 40 to 80 mi. wide, and has an area of about 20,000 sq. mi. A mountain range often 3,000 ft. high crosses it from north to south. Vancouver



COURTESY AMER. MUS. OF NATL. HISTORY

KWAKIUTL INDIAN HOUSE AND TOTEM OF VANCOUVER ISLAND.
(FROM A MODEL BY NED J. BURNS)

possesses great scenic beauty and extensive natural resources, including coal mines, forests and fishing coasts. **VICTORIA**, the capital city of British Columbia, is situated at the extreme south of the island. Pop. with Comox, 20,952.

VANDAL, an extinct East GERMANIC dialect closely akin to GOTHIC and spoken by the Vandals who, after long migrations through Europe, finally established themselves in northern Africa, where they were decisively defeated by the Eastern Empire in 534.

BIBLIOGRAPHY.—F. Wrede, *Die Sprache der Vandalen*, 1886.

VANDALIA, a projected colonizing enterprise and separate province west of the Allegheny Mountains, authorized by the Crown but never established because of the Revolutionary War. The Vandalia Co., originally called the Walpole Co., was organized in 1769 with members in both England and America, Thomas Walpole, Benjamin Franklin, John Sargent, Sir William Johnson, James Croghan, Thomas Pownall and others. The company agreed with the Lords of the Treasury to pay £10,460, 7s., 3d., for about 13,700,000 acres south of the Ohio and east of the mouth of the Scioto, land on which the Iroquois title had been extinguished in the Treaty of Fort Stanwix, 1768. Franklin overcame the reluctance of the Board of Trade to authorize the enterprise in view of the PROCLAMATION OF 1763. George III gave his approval in Aug. 1772 and the Board of Trade, probably taking the Massachusetts Bay charter as a model, devised a constitution for the Colony of Vandalia. The colony was to extend to the Kentucky River, embracing a larger territory than the company

grant; it was not to be a proprietary colony but a royal province with an Established Church. The Privy Council in May 1775 requested that Walpole and his associates delay execution of the project until hostilities should cease. After the Revolution Congress refused to recognize the company's claims.

VANDALS, a Germanic tribe whose original home was north of the upper Danube. During the 4th century they occupied Pannonia. A raid into Italy in 405 proved abortive; but the next year they crossed the Danube and made their way beyond the Rhine into northern Gaul. In 409 they crossed the Pyrenees into Spain accompanied by other German tribes. Here they were defeated by the Visigoths, but managed to retain control of southern Spain. About 429 the whole Vandal tribe, led by their chief **GAISERIC**, crossed into Africa. The Roman Government, weak and divided, offered but feeble resistance. Carthage was captured in 439. Masters of Roman Africa, they appropriated such land as they chose and levied heavy taxes on the inhabitants. As pirates they ravaged the shores of the Mediterranean. In 455 they raided Rome, looting the city for two weeks. After the death of Gaiseric the Vandal kingdom declined, and was easily destroyed by Belisarius in 534. The evil reputation of the Vandals is not wholly deserved, and is probably due to the fact that as Arians they treated orthodox Christians harshly. Robbers and pirates they were, but not wanton destroyers. The Christian Salvianus even says that they improved the morals of Roman Africa.

VANDERBILT, CORNELIUS (1794-1877), American capitalist and financier, was born near Stapleton, Staten Island, N.Y., May 27, 1794, a farmer's son. He had little school education. At 16 he started a ferry service between Staten Island and New York, hauling freight and passengers in a sailboat. After two years Vanderbilt improved his ferry service by the addition of two boats, and in 1817 he became captain of the first steam ferry operating between New York and Brunswick, N.J. His fleet of boats grew rapidly, and he extended his service to points adjacent to the harbor. In 1824, he organized a water transportation company, in which Vanderbilt (or the "Commodore," as he had begun to be known) held a substantial interest, and five years later he launched the first steamboat of a fleet which he operated in competition with the Hudson River and the Long Island Sound lines. His first major achievement was the establishment, in 1851, of a fast water-service to California, in which time was saved by transporting the passengers across the Nicaraguan isthmus. During 1855-61, he operated a passenger service between Le Havre and New York, taking advantage of the enforced absence of much British transatlantic shipping during the Crimean War (1853-56). When the line was well established, Vanderbilt began to lose interest in ocean traffic, and in 1857-62 he sold all his steamship properties, devoting himself thereafter to railway enterprises. He was made president of the New York & Harlem

Railway in 1863, and then purchased a majority interest in the Hudson River Railway, being made president of that road in 1865. Three years later he held a similar post with the New York Central Railroad, and he merged the Hudson River Railway in it in 1869.

Vanderbilt displayed great ability in the management of these early American carriers, and increased revenues rewarded the foresight he employed in opening new lines. He next acquired the Lake Shore and Michigan Central lines, which gave him a through service to Chicago. By buying control of the Canadian Southern Railways, he was able to direct an enormous freightage to his American roads.

Vanderbilt died at New York, Jan. 4, 1877, leaving a fortune of approximately \$100,000,000. Of this estate, \$1,000,000 was bequeathed for the founding of Vanderbilt University, Nashville, Tenn., the bulk of the remainder being left to his eldest son, William Henry Vanderbilt (1821-85), capitalist, born at New Brunswick, N.J., May 8, 1821. The son began his career as a banker's clerk, and, in 1860, was made receiver of the Staten Island (N.Y.) Railway. In 1877, he was made president of the New York Central Railroad and its subsidiaries, succeeding his father. He presented \$103,000 to the New York municipality for the erection of an Egyptian obelisk in Central Park, New York City. He died in New York, Dec. 8, 1885. The majority of his railroad directorates were assumed by his eldest son, Cornelius Vanderbilt (1843-99), financier, born at New Dorp, Staten Island, N.Y., Nov. 27, 1843. In 1886, he became chairman of the New York Central Railroad. He died in New York, Sept. 12, 1899.

His estate was left to his son, Cornelius Vanderbilt III (1873-), capitalist, born at New York, Sept. 5, 1873. He was graduated from Yale University in 1899 with a degree in mechanical engineering, and the same year with his brothers Alfred Gwynne and Reginald Claypoole inherited control of his father's railroad and banking interests.

VANDERBILT UNIVERSITY at Nashville, Tenn., a coeducational, non-sectarian and privately controlled institution, was chartered in 1872. The number of women students is limited. The university comprises a College of Arts and Science, and professional schools of Engineering, Law, Medicine and Theology. It had productive funds in 1931 amounting to \$19,853,819. The library contained 150,000 volumes. In 1931-32 there were 1,573 students, and a faculty of 198 headed by Chancellor **JAMES H. KIRKLAND**.

VANDERGRIFT, a borough in Westmoreland Co., southwestern Pennsylvania, situated on the Kiskiminetas River, about 20 mi. northeast of Pittsburgh. It is served by the Pennsylvania Railroad. Farming is carried on in this region. Coal and natural gas are produced in the vicinity, and sheet iron, tin plate and gloves are manufactured here. A large foundry is in Vandergrift. The retail trade in 1929 amounted to \$5,683,687. Vandergrift Heights con-

solidated with Vandergrift in July 1915. Pop. 1920, 9,531; 1930, 11,479.

VANDERLIP, FRANK ARTHUR (1864-), American banker, was born at Aurora, Ill., Nov. 27, 1864. He attended Illinois University and the University of Chicago, and was in turn reporter and financial editor on Chicago newspapers. Because of his knowledge of finance, he was made private secretary to Lyman Gage, Secretary of the Treasury, in 1897, and the same year was appointed assistant Secretary of the Treasury. In 1901 he resigned that office to become vice-president of the National City Bank of New York, and was promoted to the presidency in 1909. When the United States entered the World War, Vanderlip was made chairman of the War Savings Committee in charge of the sale of government certificates. In 1919 he retired from active banking. He is the author of *Modern Banking* and *International Banking*.

VANDERLYN, JOHN (1776-1852), American painter, was born at Kingston, N.Y., Oct. 15, 1776. He studied with Gilbert Stuart in Philadelphia and began his professional career in New York by painting portraits of Citizen Adet, the French minister, Albert Gallatin and Theodosia Burr. He went to Paris in 1796, became a pupil of Vincent and exhibited in the Paris Salon in 1800. His better known works include *The Massacre of Miss McCrea*, in the Wadsworth Athenaeum, Hartford, Conn.; *Caius Marius amidst the Ruins of Carthage*; *Ariadne Asleep in the Island of Maxos*, in the Pennsylvania Academy; and portraits of Abraham Hasbrouck and John A. Sidell. Vanderlyn died at Kingston, N.Y., Sept. 24, 1852.

VAN DER WAALS, JOHANNES DIDERIK (1837-1923), Dutch physicist, was born at Leiden, Nov. 23, 1837. At Leiden University he attracted scientific interest in 1873 by his thesis on the continuity of the liquid and gaseous conditions. He became professor of physics at the University of Amsterdam in 1877. He became known for his new derivation of an equation of state for gases, which went far beyond the laws of Robert Boyle and Joseph Gay-Lussac; his work in the kinetic theory of gases, and its application to fluids, and the extension of this, by means of "critical" values, to the "law of corresponding states." He retired from the university in 1907, was awarded the Nobel Prize in physics in 1910, and died at Amsterdam, on Mar. 9, 1923.

VAN DER WAALS' EQUATION, a relation between pressure, volume and temperature for pure gases and liquids formulated as follows:

$$(p + \frac{a}{V^2})(V - b) = RT$$

Here p is the pressure; V is the volume occupied by one gram-molecular weight of the gas; T is the absolute temperature; and R is the gas constant, the same for all gases. The constants a and b , the so-called van der Waals' constants, are characteristic of the gas in question. The term (a/V^2) represents a pressure

effect due to the attractions between the molecules which assist the externally applied pressure in compressing the gas; b represents the small volume occupied by the molecules themselves which sets a limit to the compression experienced by the gas under very high pressures, since the free space subject to change is then only $(V - b)$. At high temperatures and low pressures, the equation reduces to the ideal gas law $pV = RT$. See BOYLE'S LAW. L. O. C.

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VAN DOREN, CARL (1885-), American critic and writer, was born at Hope, Ill., Sept. 10, 1885. He taught English at the University of Illinois until 1916, when he became an associate professor in English at Columbia University. He was managing editor of the *Cambridge History of American Literature*, 1917-21, literary editor of *The Nation*, 1919-22, and literary editor of *The Century Magazine*, 1922-25. Van Doren's critical works include *The American Novel*, 1921, *A Short History of American Literature*, 1922 and *The Roving Critic*, 1923. He has published one novel, *The Ninth Wave*, 1926. *Swift*, a biography, appeared in 1930.

VAN DYCK, SIR ANTHONY (1599-1641) one of the greatest Flemish painters, was born at Antwerp, Mar. 22, 1599, the son of a merchant. In 1609 he became the pupil of Van Balen, and 9 years later was admitted to the Painters' Guild of St. Luke and received the freedom of Antwerp, both extraordinary distinctions for so young a man. Shortly after, his association with Rubens began. He was never his pupil, but a recognized assistant, and, at this time, his work is hard to differentiate from Rubens's own. Acting on Rubens's advice Van Dyck visited Italy in 1623. There he spent 5 years, mainly in Genoa, where he painted many superb portraits of the Genoese aristocracy, which betray his passionate study of Titian by their richer and more glowing color. He acquired also the suave dignity of line and arrangement, henceforth so characteristic of his style. In 1632 Charles I, impressed by one of Van Dyck's portraits, invited the painter to England, where, lodged in a royal palace, he was granted a pension of about \$1,000 for life, and knighted. His great personal beauty and distinction were as remarkable as his talent. He settled in England, where his success as a portrait painter enabled him to live magnificently. There he painted the great series of unsurpassed portraits which proclaim him a master among masters. Happily his pictures have retained their pristine beauty to an extraordinary degree. His principal devotional and allegorical works were painted for the most part during his Flemish period; such are the Antwerp *Saint Augustine* and the Ghent *Crucifixion*. The incessant demand for portraits, together with the painter's crowded and luxurious life, overtaxed his strength, and he died at London, Dec. 9, 1641. He was buried in Old St. Paul's, near the tomb of John of Gaunt. Notwithstanding his extravagant style of living, Van Dyck left a fortune of \$100,000.

VAN DYKE, HENRY (1852-), American writer and preacher, was born at Germantown, Pa., Nov. 10, 1852. He was educated at Princeton University and Theological School. His first charge was at Newport, R.I., and in 1883 he went to the Brick Presbyterian Church, New York City, where he became famous as a preacher. In 1900 he was Professor of English literature at Princeton, and from 1913-17 Minister to Holland and Luxembourg. Meantime, through his work in the fields of essay, poetry and short story, he was winning a distinctive place for himself. His writings are delicate in craftsmanship, and imbued with spiritual quality. Among his principal books are *Poems*, *The Blue Flower*, *Little Rivers* and *The Ruling Passion*. *The Other Wise Man* is perhaps his best known short story.

VAN DYKE, JOHN CHARLES (1856-), American educator, was born at New Brunswick, N.J., Apr. 21, 1856. He studied at Columbia and spent many years in Europe studying art. Though admitted to the bar in 1877, Van Dyke never practiced. He became librarian at Sage Library, New Brunswick in 1878 and professor of history of art at Rutgers in 1889. He has also lectured at Columbia, Harvard and Princeton universities. From 1883-84, he edited *The Studio*; and from 1887-88, the *Art Review*. Van Dyke was editor of *College Histories of Art*, *History of American Art*, and *Autobiography of Andrew Carnegie*, 1921; and author of *Principles of Art*, 1887; *History of Painting*, 1894; *Italian Painting*, 1902; *The New New York*, 1909; *Rembrandt and His School*, 1923; *The Rembrandt Drawings and Etchings*, 1927, and *In Java*, 1929.

VANE, SIR HENRY (1589-1654), English statesman, was born in Kent, Feb. 18, 1589. He was a member of Parliament during the reign of James I, and held important offices under Charles I, serving as ambassador to Sweden and later secretary of state. He was active in the impeachment of the Earl of Strafford, and turned against Charles I, becoming a member of the first Parliament of the Protectorate. Vane died in 1654.

VANER, LAKE. See WENER.

VAN EYCK, HUBERT. See EYCK, VAN, HUBERT.

VAN EYCK, JAN. See EYCK, VAN, JAN.

VAN HISE, CHARLES RICHARD (1857-1918), American geologist, born at Fulton, Wis., May 29, 1857. He was graduated from the University of Wisconsin in 1879, successively taught metallurgy, mineralogy and geology there, and, in 1903, was made president of the university. In 1883 he became geologist of the U.S. Geological Survey, taking over the division of Pre-Cambrian and metamorphic geology in 1900. He founded the *Journal of Geology* in 1892 and was one of its editors. In addition, he held the presidency of the Geological Society of America in 1907. He was one of the leaders of the school of dynamic geology and an authority upon the ore deposits and geological structure of the territory about Lake Superior. His principal work was *Treatise on*

Metamorphism, 1904. He wrote other geological works and a number of books urging the conservation of natural resources. He died at Milwaukee, Wis., Nov. 19, 1918.

VANILLA (*V. fragrans*), a somewhat fleshy, tall-climbing orchid extensively planted in warm countries for its seed pod which yields vanilla extract. The plant grows wild from the borders of the Everglades in Florida to Mexico and Central America. On the vigorous stem, which climbs by rootlets, are borne thick, oblong leaves, 6 to 8 in. in length, numerous clusters of large, greenish-yellow flowers and fleshy, beanlike pods, about 8 in. long, enclosing an aromatic pulp and small black seeds. B. H. S.

VANILLA GRASS, a name sometimes applied to the HOLY GRASS, a small, sweet-scented perennial found in Canada and the northern United States.

VANIR, in Scandinavian mythology, three gods of nature, Njorth, FREY and FREYIA, who forced the AESIR to take them into their assembly.

VANITY FAIR, a novel by WILLIAM MAKEPEACE THACKERAY; published 1848. Depicting with such amazing thoroughness and perception every human type, every nook and cranny of early 19th century English society, the book is ranked as "the classic novel of society." Chief of all the characters in the great "Vanity Fair" is the green-eyed BECKY SHARP, a clever and unscrupulous adventuress whose determination and efforts to climb to the loftiest height of society form the main interest in this "novel without a hero." Contrasted with Becky is Amelia Sedley, the noble wife of George Osborne, a spoiled and worthless young man. Other important characters are Becky's gambling husband, Rawdon Crawley; Dobbin, awkward and faithful, whose devotion to Amelia is finally repaid after Osborne's death by Amelia's love; Joseph Sedley, "collector of Boggley Wallah," Amelia's brother and Becky's final conquest; Lord Steyne, Becky's lover; and the reprobate old Sir Pitt Crawley. There are some memorable scenes of the Napoleonic campaign of 1815, though Rawdon's discovery that Becky is Lord Steyne's mistress is perhaps the most dramatic scene in the book.

VANNER, in ORE TREATMENT, a machine used for concentrating fine SAND and SLIME ores. It comprises a moving, inclined, endless belt, usually of rubber. Water flowing down the belt carries the lighter GANGUE particles with it, the heavier ORES travelling up on the belt and being dumped into a launder, or trough for concentrates. See also ORE TREATMENT.

VANNIC, an extinct language of Asia Minor preserved in CUNEIFORM texts found in the region of Lake Van and dating from the 9th and 8th centuries B.C. Because of repeated mention of a deity, Khaldi, it is often called Khaldian. The morphology of its noun is fairly clear, but its linguistic affinities are as yet quite uncertain.

VAN RENSSELAER, MARTHA (1864-1932), American home economist, was born at Randolph, N.Y., June 21, 1864. In 1894-1900 she was school

commissioner of Cattaraugus Co., N.Y., and in 1900 became extension leader of the agricultural college of Cornell University. In 1911 she was appointed professor of home economics and director of the home economics college of Cornell where she won recognition as a leading authority in her field. In 1918-19 she was a member of the executive staff of the U.S. Food Administration. She was selected by the National League of Women Voters in 1923 as one of the 12 greatest living American women. Miss Van Rensselaer died in New York City May 26, 1932.

VAN RENSSELAER, STEPHEN (1764-1839), American soldier and political leader, was born in New York City, Nov. 1, 1764, and graduated from Harvard in 1782. He was a Federalist member of the New York Assembly, 1789-90, 1808-10 and 1818, and of the State Senate 1791-95. As major-general of the First Division of detached militia of New York State, he was defeated at the battle of Queenston Heights on Oct. 13, 1812, and the ensuing criticism led him to resign from the army. From 1816 until his death he was a member of the board of commissioners of the Erie Canal, of which he was president for over 14 years. In 1819 he became a regent of the University of the State of New York and for a time was its chancellor. Later he founded and financially assisted Rensselaer Polytechnic Institute at Troy. From 1822 to 1829 he was a member of the House of Representatives. He died at Albany, N.Y., Jan. 26, 1839.

VAN'T HOFF, JACOBUS HENRICUS (1852-1911), Dutch chemist, was born in Rotterdam, Aug. 30, 1852. He first attended the polytechnic institute at Delft, afterwards went to Leiden, then to Bonn, where he studied with S. F. A. Kékulé, Paris and Utrecht, and in 1878 was appointed to the chair of chemistry at the University of Amsterdam. In 1896 he accepted a research professorship of the Prussian Academy of Sciences in Berlin, which involved no teaching. His work on organic compounds, especially on lactic acid, which he performed at the early age of 22, and simultaneously, and independently of that of Le Bel, gave the first definite indication of the existence of asymmetrical carbon atoms, and formed the basis of stereochemistry. Later on he turned his attention to the application of thermodynamics to chemistry, to the study of chemical reactions, reversible processes, and chemical equilibrium, as well as to the behavior of solutions, and the law concerning osmotic pressure, which bears his name. Elected a foreign member of the Royal Society, he was awarded the Davy medal in 1893, and was the first chemist to receive the Nobel prize, 1901. He died at Steglitz, Mar. 1, 1911.

VAN TYNE, CLAUDE HALSTEAD (1869-1930), American historian and educator, was born at Tecumseh, Mich., on Oct. 16, 1869. He graduated at the University of Michigan in 1896, and studied at Heidelberg, Leipzig and Paris. He was an instructor of history at the University of Pennsylvania, 1900-03, and then professor of history at the University of

Michigan, where he was made head of the history department in 1911. His chief historical work was the *History of the Founding of the American Republic*, planned to comprise three volumes, of which only two, *The Causes of the War of Independence*, and *The War of Independence*, were completed at the time of his death. For the latter volume he was posthumously awarded the Pulitzer Prize for American history in 1930. In this work, Van Tyne displays an amazing breadth of knowledge of the Revolutionary period, the result of painstaking researches in the Clements Library and in the archives of Paris and London. Among his other works are *The American Revolution* (American Nation series), *The Loyalists in the American Revolution*, and *India in Ferment*. He died at Ann Arbor on Mar. 21, 1930.

VAN WERT, a city in northwestern Ohio, the county seat of Van Wert Co., situated 30 mi. northeast of Lima. It is served by bus lines and two railroads. Grain is the chief crop of this district, which is noted for its flower gardens. The local manufactures include overalls, cigars, wood shapers, glue heaters and pots, metal kits and containers. Van Wert was founded in 1837; incorporated in 1848. Pop. 1920, 8,100; 1930, 8,472.

VAPOR, a term sometimes employed as a synonym for gas in naming the most tenuous of the three states of matter; often used more specifically as designating a substance in the gaseous state but below its critical temperature. *See* CRITICAL PRESSURE; GAS.

VAPORIZATION, the conversion of liquid to vapor, usually by artificial means, as the conversion of water to steam. The rate of evaporation of a liquid depends on its temperature, its physical nature, the area of its surface and the motion, pressure and dryness of the air above it.

The KINETIC THEORY of matter holds that all substances are made up of MOLECULES in motion and that the molecules, as a whole, have a very definite average velocity which depends upon the temperature. However, the velocities of individual molecules differ widely. High-velocity molecules near the surface of a liquid escape. Although some are drawn back by the attraction of the surface molecules, many get away into the air above, the entire quantity of the liquid evaporating in this manner.

A given mass of substance in the vapor state occupies many times the volume which it would occupy in the liquid form. This means that work must be done against the force of molecular attraction (*see* COHESION) in separating the molecules. This work is stored in the vapor in the form of potential energy, i.e., energy of position, and is given up in the form of LATENT HEAT when the vapor condenses. The latent heat of vaporization of water is approximately 540 calories per gram; thus, when a gram of steam condenses, it gives up 540 calories of heat. That is why steam is valuable for heating purposes.

If a dish of water is placed in an enclosed space, the molecules will continue to leave the water until the number leaving in unit time is just balanced by

the number returning in the same time. The space above the liquid is then *saturated*. The number of molecules per unit of volume at saturation depends on the temperature, a given volume of saturated warm air containing more molecules than the same volume of saturated cold air. Rain drops are formed when saturated warm air is suddenly cooled, and dew is formed when unsaturated air is cooled below the point of saturation. E. J. M.

VAPOR PHASE. See CRACKING PROCESSES; PHASE RULE.

VAPOR PRESSURE. The pressure exerted by a VAPOR in equilibrium with a solid or liquid. It is, therefore, the pressure of incipient condensation.

The vapor pressure of a system of definite composition is a function of the temperature and pressure of the system. Ordinarily, however, the effect of total pressure on the vapor pressure is small, hence the vapor pressure of a system of fixed composition is usually regarded as a function of temperature alone. The vapor pressure exerted by any one component in a multi-component system (see PHASE RULE) is a function of the vapor pressure of the pure component, and the composition, temperature, and total pressure of the system.

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VAPOR-PRESSURE THERMOMETERS. Since the pressure due to a saturated vapor (see VAPORIZATION) depends upon the temperature only, temperature is sometimes measured by observing the vapor pressure from some liquid for which accurate data are available. This method is used especially for extremely low temperatures. The lowest temperatures yet attained, within a degree or two of absolute zero (see ABSOLUTE TEMPERATURE SCALE), are measured in terms of the vapor pressure of liquid HELIUM. See also THERMOMETRY. W. W. S.

VAPOR TUBE LAMPS. See GASEOUS-CONDUCTOR LAMPS.

VARDAR, the largest river of Macedonia, rising in the Shar Mountains in northwestern Macedonia and flowing in a southerly direction toward Salonika. SKOPLJE, the capital of the Vardar Banovine of the Yugoslav kingdom, is situated on the banks of the Vardar. VELES is another important town lying on the banks of the river. The Vardar empties into the Aegean at the Gulf of Salonika, about 12 mi. southwest of the city. For the most part of its 200-mi. course the Vardar is rapid and unnavigable. It passes through many rocky gorges until it descends to the Salonika plain where it widens and in the spring floods the entire district. The Vardar is a beloved river and figures in folk-tales and poems.

VARESE, a town of northwestern Italy situated 37 mi. northwest of Milan. The town is about 1,200 ft. above sea level and is famous for its Church of St. Victor, and for the pilgrimage Church of the Madonna del Monte. Varese is a center for silk spinning, tanning and paper making. Pop. 1931, 42,645.

VARIABILITY, in statistics, the spread, scatter, variation or dispersion of the individual items in a series of comparable measurements. The investigation and the measurement of the variability of a series of terms is frequently just as important as the determination of their average. Some measures of variability presuppose the grouping of the data by size (see FREQUENCY DISTRIBUTION); others can also be directly computed from ungrouped data.

The range is the interval between the lowest term of a series and the highest. It is an unreliable measure of variability since, even under similar conditions, the range is affected by haphazard variations. Scientific measures of variability are based upon the extent of the variation about some form of average such as the arithmetic mean or the median. The mean deviation is the arithmetic mean of the differences between the individual terms of a series and their arithmetic mean or median. In obtaining these differences the smaller value is subtracted from the greater, no consideration of algebraic sign being involved. The standard deviation, root-mean-square deviation, is the square root of the arithmetic mean of the squares of the differences between the individual terms and their arithmetic mean. The standard deviation has additional significance because of its relation to the mathematical theory of probability and to further extensions of statistical theory.

The quarterly deviation or semi-interquartile range is one half of the range in the centrally located group which includes one half of the observations, this group being bounded by the first quartile and the third quartile.

Relative measures of variability, independent of physical units, are determined as ratios such as mean deviation to arithmetic mean or median; standard deviation to arithmetic mean—when multiplied by 100 termed the coefficient of variation and quartile deviation to the average of the first and third quartiles. E. T. F.

BIBLIOGRAPHY.—G. Udny Yule, *An Introduction to the Theory of Statistics*; Harry Jerome, *Statistical Method*; R. W. Burgess, *Introduction to the Mathematics of Statistics*.

VARIABLE, a quantity, including number, which in a given mathematical discussion varies in value. For example, in the formula for the circumference of a circle, $C = 2\pi r$, we may consider r as having any value we please, the value of C depending on the value of r . We therefore speak of r as an independent variable, and of C as a dependent variable. We may consider C as taking any value we please, in which case the value of r will depend upon that of C , r being then the dependent and C the independent variable. In either case, 2 and π are constants. See CONSTANT; CALCULUS; MAXIMUM AND MINIMUM VALUES.

VARIABLE GEARS OR GEARING, mechanisms containing gearing, friction discs or other means of securing different speed ratios between the driver and driven members of a machine. Variable speeds can also be secured by BELTING and by hydraulic mechanisms.

VARIABLE STARS, whose brightness is subject to variation, may be divided into two main groups; those that are inherently variable in brightness, and those whose light only appears to change. The latter are in reality **DOUBLE STARS** oriented in space in such a way that in the course of their revolution one star will pass directly in front of the other, as seen from the earth, and thus eclipse some or all of its light. These stars are called **ECLIPSING BINARIES**. Several hundred of them are known and several have been carefully studied. Among the inherently variable stars two great groups may again be recognized: the periodic stars, and the irregular variables. The periodic may be further subdivided into the cluster variables, the Cepheids, and the long-period variables.

The first of these are white in color, vary roughly about one magnitude or less in brightness in a period of around 13 hours, and are given their name because of their frequent occurrence in star clusters. Their intrinsic luminosity averages 100 times brighter than the sun. The Cepheids, so named after the first one discovered, Delta Cephei, are yellow in color, have periods generally between 4 and 20 days, and vary from one-half to one magnitude in brightness. The length of period is closely correlated to intrinsic luminosity. The Cepheids thus form one of the best measuring rods in the universe. They are of great luminosity, averaging some 1000 times as bright as the sun and can be seen at great distances. The change in brightness among Cepheids is probably due to a pulsation in the stars themselves. A similar explanation may hold for the cluster variables which in many ways appear to be related to the Cepheids. The former, however, are very rapidly moving stars while the velocities of the Cepheids average only about 10 miles per second.

The long-period variables, which are deep red in color, generally have periods between 200 and 400 days. They vary in brightness over a wide range, sometimes as much as eight or nine magnitudes, or a light range of 1 to 2500. The length of the period as well as the brightness reached at each maximum or minimum light are subject to considerable fluctuations. At maximum light, these stars are about 100 times brighter than the sun. They are very large stars, perhaps 100 times as large as the sun and generally have the high velocities of some 40-50 miles per second. The cause of their light variation is still unknown. The best known example of this type is Mira Ceti, also the first one discovered.

Among the irregular variables there are some which are normally faint, but brighten up suddenly at irregular intervals. Others are normally bright and occasionally become faint. Still others show some resemblance to the Cepheids, and a few, notably those in the Orion nebula and other similar nebulae, vary in such a way as to suggest that their light is really constant but that they are intermittently obscured by the drifting of dark matter between us and the star.

Lastly among variable stars may be mentioned new stars or novae, whose variations are real and far more

pronounced than those of an ordinary variable, but occur only once. At present more than 5,000 variable stars are known, the majority of which are situated in the Magellanic Clouds or in the Milky Way. The light variations of the brightest among these may be followed to advantage by amateurs with small telescopic equipment. Notable contributions in this field have been made by the members of the American Association of Variable Star Observers. W. J. L.

VARIATION, in biology. Within each species of animal or plant there may be considerable variation. Some of the differences between individuals of a single species may be due to environmental differences acting during development but there are many others which have a hereditary basis. The individuals of a species may inherit different combinations of hereditary factors (genes) but since most of their hereditary factors are the same the individuals resemble one another sufficiently close to be called collectively a species.

Environment may have a profound effect upon an organism. The blind cave salamander *Typhlotriton* owes its degenerate eyes and pale tones to the absence of light in post-metamorphic life. If this salamander is reared in the light it develops functional eyes and a dark coloration. Even more striking environmental effects have been recorded in a single species of shrimp living in waters of different salinity, and in mollusks frequenting waters of different temperature. Without an experimental analysis it is impossible to state how much of the variation within a species is due to environment and how much to heredity.

Internal environment may also produce variation. The secondary sexual characters of vertebrates owe their seasonal hypertrophy to hormones released by the gonads. Parasites may disturb the physiology of certain mollusks and crustacea sufficiently to modify their external form. Some animals such as the varying hare and some birds such as the ptarmigan may change their color with the season. The change is produced by internal factors although these are closely correlated with the season. G. K. N.

Variation in Physical Anthropology may be said to be the science of the variations of man. In every detail and in every trait there is a range of variation. But to Quetelet goes the distinction of first placing the study of these differences on a mathematical basis. He pointed out that for many human traits the distribution of their variations falls into a bell-shaped curve or normal curve, with the greatest frequency in the center falling away symmetrically on either side. The implications of this discovery have been of great consequence and form a cornerstone for the structure of biometrics.

For each of his traits man not only varies from individual to individual but from male to female. (See **SEX CHARACTERS**.) In innumerable ways sex variations are apparent in the human body. It is possible to arrange a continuous series in many characters from the ultra-masculine to the ultra-feminine. In collections of crania or pelves it is repeatedly brought to

notice that there is a gradation from clearly marked and definitely male to the female. Always there is a small residuum for which it is difficult if not impossible to determine the sex.

Just as man varies individually and sexually within his group, he also varies from group to group or from race to race. Although the distributions may overlap, the maximum frequencies or averages of two groups may be distinct. These averages for a large number of groups can be arranged to form a continuous distribution.

H. L. S.

VARICOSE VEINS, a condition in which there are dilated, enlarged, elongated, tortuous veins. This disabling condition has been recognized as one of man's afflictions since the earliest records known to science. Some authorities have estimated that more than one half of the adult population of the country are affected with this malady.

Varicose veins, when neglected, often act as a causative factor in the production of ulcerations on the lower legs, which are termed varicose ulcers, yet only a small percentage of the great number of men and women whose veins have become varicose have this complication.

There is no one definite cause for the formation of varicose veins. It has been thought that their development was associated with child-birth and that only rarely did men have them. Statistics recently collected show that up to the twentieth year about equal numbers of men and women are affected, but that from this age on increasingly more women than men have varicose veins. In later life women particularly are affected because of pregnancy and also because of the menopause. The majority of cases develop during the second pregnancy, and although the disease improves immediately after confinement, it continues still, growing worse and more extensive. With each succeeding pregnancy the varices extend rapidly and dilate, often disabling the patient during the last two or three months before confinement.

Varicose veins are more common in the working man or woman and particularly in those who stand many hours on their feet. This is explained by the force of gravity which is constantly exerting itself on the fluid blood, bringing about pressure upon the vein walls which weakens them. It is believed also that people with varicose veins have congenitally weak-walled veins.

Normally, the flow of blood is toward the feet in the arteries and back toward the heart in the veins. In the fully developed case of varicose veins, this is no longer the case, and the veins are merely dilated sacks of stagnant blood which fill or empty as gravity exerts its influence. It is for this reason that the lower legs so often swell by night and then are found normal in the morning.

Several complications of varicose veins are likely to develop. Most common is a FOCAL INFECTION within the vein, coming by way of the blood stream from some distant part of the body such as the teeth, tonsils, etc. This is called PHLEBITIS. This infection is most

likely to develop in veins in which the blood flow is slowed or stagnant. It involves most often the large, dilated varicose veins just under the skin, though it may involve the deep veins also. It occurs especially after operations or following confinement, and has been spoken of as "*milk leg*," because the swelling was coincident with the filling of the breasts. The swelling was due to the lymphatic blockade and caused the leg to become a glistening white. If this infection is severe, the leg never recovers fully.

Due to the slowing of the blood stream, the tissues of the lower leg gradually become saturated with the blood serum which is the fluid part of the blood. This tends to lower the resistance of the tissues to injury and infection. Should such a patient get a severe bruise of this area, the tissue will often die locally and the skin slough off, leaving an open *ulcer* which in the past has often taken years to heal. Even though the ulcer does heal, it is much more liable to break open a second time than it was at first.

Often a severe skin infection with an intense *itching* develops over the area affected by varicose veins. At times this itching is almost unbearable and it is resistant to treatment.

Until within a few years the use of bandages and elastic stockings has been the main hope for relief from these conditions. Many surgeons have attempted to operate and remove the varicose veins. To-day the injection method of treatment is chiefly used. In this treatment it is recognized that the affected veins are of no value. With this idea in mind, various solutions are injected into the varicose veins which cause hard clots or thrombi to form. The solution also injures and stimulates the lining of the vein, so that after a time the vein becomes a mere hardened cord of scar tissue and the blood ceases to pass through it, being shunted off into normal veins.

Not all the veins treated by the injection method remain cured, and new varicose veins may form; yet these can be treated easily at another time and the patient kept in a state of health.

Varicose ulcers are cured easily and quickly by bandaging the lower legs tightly to overcome the stasis of the blood stream and to force out the excess fluid, thus restoring the tissues once more to the normal condition. They soon heal and ulcers that have been open sores for years close in one to two months.

H. O. McP.

VARIETY, in taxonomy, a subdivision of a species. Varieties of a single species differ by minor characters, such as pubescence, color, and size, and they intergrade each with one another and with the species. The distinguishing characters of varieties are considered to be too inconstant or too trivial to entitle them to recognition as species. However, there are often differences of opinion among biologists as to whether these minor groups are to be regarded as species or varieties. Many zoologists and a few botanists apply the term subspecies to the primary subdivision of species, but most botanists use the term variety for such subdivisions. Among cultivated plants

variety is used for a form which is kept true to its essential characters by seed selection, as the grains, garden vegetables and other annuals, or by vegetative propagation, as in fruit trees, bulbous plants, and the like. Crosses between varieties are usually fertile.

A. S. H.

VARIOMETER, in geophysics, an instrument used to measure variations in the intensity and direction of the earth's magnetic force. It comprises, essentially, a sensitive, balanced, magnetic needle which readily indicates and measures small variations of the order of 10^{-5} gauss. See also MAGNETOMETER; GEOPHYSICS.

VARIOMETER, in radio, an arrangement of two INDUCTION COILS whose relative positions may be changed in such a manner as to change the overall INDUCTANCE. The device has been used for tuning a radio circuit where a fixed value of CAPACITY is used. See also TUNED CIRCUIT.

VARNA, a seaport and city of Bulgaria and capital of the district of Varna, situated on the Black Sea, protected by an artificial jetty at the wide mouth of the Devna River. It is the terminus of the railroads to Ruschuk and Sofia. Following the World War the city lost considerable trade due to the annexation by Rumania of the Dobrudja hinterland, but it still remains one of the chief ports of the country, from 50 to 60% of the Bulgarian Black Sea trade being concentrated in Varna. The chief imports are manufactured goods, particularly textiles, leather, chemicals, metal wares, and groceries. The exports are principally cattle and agricultural products. It has a college of commerce, a chamber of commerce, a rich marine museum, winter and summer civic theaters and is the see of a Greek metropolitan. Varna is rapidly becoming the chief seaside resort on the Black Sea. Modern bath houses have been built, and vacationists from Turkey, Rumania and even from Poland, Czechoslovakia, Austria and other central European countries visit Varna in the summer, when the population is quadrupled. A few miles up the shore of the bay is the palace of Evksinograd, the summer estate of King Boris. Varna was founded in the 6th century B.C. In 1444 King Wladislas III of Hungary and Poland lost his life here in a battle with the Turks. Upon the defeat of Turkey in 1878 Varna was incorporated with the newly-created Bulgarian state. Among the inhabitants are large numbers of Greeks, Armenians, Turks, Spanish Jews, Tatars and gypsies. Pop. 1931, 61,454.

VARNHAGEN, FRANCISCO ADOLFO DE (1816-1878), Brazilian historian and diplomat. He became secretary of the legation of Brazil in Madrid, where he studied the progress, government and interior administration of Brazil, and in 1854 published his *Historia Geral do Brazil*. In 1859 he returned to Brazil and was named resident minister to Paraguay, and later appointed by the government to travel in Venezuela, New Granada, Ecuador and the Greater Antilles, studying their agricultural progress. He was then sent to Peru where, at Lima, he began the study of Amerigo Vespucci, which he later continued in

Vienna. These studies revolutionized the scientific world in regard to geography and the discoveries made in America. Among his important works are *Amerigo Vespucci: son caractère, ses écrits, sa vie et ses navigations* (1865) and *Nouvelles recherches sur les derniers voyages du navigateur florentin, 1874*.

VARNISH AND ITS MANUFACTURE. A varnish is a liquid used for the protection and beautifying of surfaces. It is generally applied to the surface either by brushing or spraying but may also be flowed on or dipped. The liquid film applied to a surface dries partly by oxidation and partly by POLYMERIZATION or condensation to a dry film which may have either a high luster or a dull finish as desired and which may vary from a pale amber to any desired color through the use of dyes or pigments. The four components from which varnishes are usually made may be classed as follows: First, the drying oil; second, the resin; third, the driers; and finally, the thinners.

The drying oil is a VEGETABLE OIL such as linseed or chinawood oils (see TUNG OIL) which has the property of absorbing a certain amount of oxygen when exposed in thin layers to form a dry film. The most common oil used in varnish making to-day is chinawood oil which is more waterproof and dries more quickly than linseed oil.

In order to increase the hardness of luster, the speed of drying or the water resistance, etc., of the oil film either natural or synthetic resins (see RESINS, SYNTHETIC) are incorporated during the varnish manufacture. The earlier varnishes made centuries ago were prepared mainly from fossil or semi-fossil resins such as the copals and dammars. The chief natural resins in use to-day are Congo, East India and kauri copals, while dammar is occasionally used where palest color is desired at the sacrifice of hardness. ROSIN and its combination with glycerine, known as ester gum, are also widely used. All of the above resins give the type of varnish known as slow drying which require generally from 24 to 48 hours to produce a hard film. Since 1924 the varnish industry has turned more and more to so-called synthetic resins which are generally based on the phenol-formaldehyde combination. These produce the so-called quick drying varnishes requiring only 2 to 4 hours to dry and possessing greater durability and waterproof qualities than the above resins. Many other types of synthetic resins are being used by the varnish industry to produce various types of coatings, among which are those prepared from cumaron and indene, from glycerol phthalate and other synthetic polymerizations.

It has long been known that very small quantities of metals such as lead, manganese and cobalt in the form of either linoleates, resinates or other soluble compounds added to the drying oil or the varnish greatly increase the speed of drying. It is therefore the practice to add to the varnish at some time during the cooking operation small quantities of these metals ranging from 0.1% to 2 or 3% of the weight of the oil used.

The resin cooked into the oil is too thick and viscous a mixture to be brushed out or sprayed and is therefore thinned down to a usable consistency with either TURPENTINE, certain petroleum fractions such as varnish makers' and painters' naphtha or mineral spirits, or in some cases coal tar solvents, such as XyLOL and TolUOL. Many other solvents are also used to a smaller or larger degree to achieve certain effects, among which may be mentioned dipentene, pine oil, and various ester solvents. Varnishes are generally prepared in open copper, aluminum or monel kettles having a capacity of from 100 to 200 gallons and are generally cooked over open fires. Using the fossil resins it is necessary to first destructively melt the resin alone by heating in the kettle to around 650° F. in order to make the fossil resins soluble or compatible with the drying oils. This is called the "running of the gum" and when melted the oil is generally added, the batch is cooked to give the desired viscosity characteristics, driers are cooked in and finally the varnish is drawn off the fire on small wheel trucks into another room and thinned down with the thinners. In some cases the driers are added in liquid form after the thinning. With rosin, ester gum, and most of the modern synthetic resins the oil and resin are generally heated together to give the desired viscosity and other characteristics without previously melting the resin.

There are many different types of varnishes made to meet definite requirements such as baking varnishes, spar or exterior varnishes, floor varnishes, furniture varnishes, insulating varnishes and those used as vehicles for a great many different types of pigmented finishes known as enamels, paints, primers and surfacers. The properties of the varnish are determined largely by the proportion of resin to oil, and by the type of resin selected. For instance, varnishes intended for marine or outside use generally contain about 2 to 3 lbs. resin to each gallon of oil, varnishes for floors must be harder and generally contain about 4 to 5 lbs. of resin to each gallon of oil, while finishes for furniture and interior use are generally still harder and contain from 8 to 14 lbs. of resin to each gallon of oil. R. J. M.

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VARNSDORF or **WARNSDORF**, a Czechoslovak city in northern Bohemia on the Saxon frontier. The city has a collegiate church, Catholic church and several vocational schools. There are important textile industries, metal works and machine and leather goods factories. The inhabitants are mostly Germans. Pop. 1930, 23,019, of which approximately 1,500 were Czechs.

VARRO, MARCUS TERENCE (116-27 B.C.), Roman author, was born in 116 B.C. Educated in Italy, he studied afterward at Athens. He entered public life as an adherent of POMPEY, though he opposed the First Triumvirate. He saw service on the Mediterranean and in Spain. He was friendly with

Caesar in private life and was employed by him to collect a huge library, about to be founded. Antony was hostile to Varro whose feelings toward the Second Triumvirate were as bitter as they were toward the first. In consequence, Varro lost his property. His later life was spent in seclusion and study. The most learned Roman scholar, he was the author of 600 books on all manner of subjects. Varro died in 27 B.C.

VASA. See VAASA.

VASARI, GIORGIO (1511-74), Italian artist and historian, was born at Arezzo, July 30, 1511. The patronage of the cardinal of Cortona enabled him to study under Michelangelo and Andrea del Sarto. In Rome he studied especially the works of Raphael. As court painter and architect at Florence, he served Cosimo de' Medici for many years. His literary masterpiece is the *Lives of the Painters, Sculptors, and Architects* (*Delle Vite de' più eccellenti pittori, scultori, ed architettori*), published at Florence in 1550. This famous work has made him the classic historian of Italian art. Vasari died at Florence, June 27, 1574.

VASCULAR SYSTEM. This is the transportation system of animal bodies. The human body is a vast community of associated cells. It needs a transportation system to feed the cells, to carry off their products and their waste. The vascular system furnishes this transportation. It forms one vast network of tubes carrying blood and lymph. There is a blood vascular system and an accessory lymph vascular system. The former consists of the blood capillaries, the heart, the arteries and veins. It contains blood which circulates at high pressure. The latter contains lymph which moves in one direction only and at low pressure. Both are present in all vertebrate animals.

THE BLOOD

Blood fills the blood vessels of the human being. It is made up of blood fluid and blood cells. The fluid (plasma) carries food, hormones and cell products in solution; it carries also heat obtained in the muscles. It is a hot water heating system.

The Blood Cells. The blood cells are of two kinds—red and white—and they have very different functions. The *red cells* are the special carriers of oxygen and carbon dioxide. They are without nuclei. Three weeks is their usual life; then they must be replaced. In the adult life they are formed only in a special part of the connective tissue; namely, the bone marrow. When they die, their bodies are carried to the spleen and liver where they are broken up chemically and the resulting chemical substances used over again for other purposes.

The *white blood cells* are less numerous in the ratio of 1 to 666. There are five varieties and all have nuclei. Many are much larger than the red cells, and they are capable of slow, independent movement. Some are strongly attracted by bacteria, which they eat and digest if the bacteria get into the blood vessels. If the bacteria are outside in the tissue spaces, they crawl through the capillary walls to get at them.

Besides the red and white cells, the blood contains

many tiny bodies called *platelets*. They are smaller even than red cells. When blood vessels are broken and blood comes in contact with air or foreign substances, these platelets, with the help of some white cells and the blood fluid, form fine, waxy filaments. These become entangled into a sticky felt called a *clot*, which becomes adherent to the edges of the tear and to everything else in the vicinity. This closes the leak. (See also BLOOD.)

THE BLOOD VASCULAR SYSTEM

The Capillaries. Of the four parts constituting this system the capillaries constitute the most important one. Heart, arteries and veins exist only to serve the capillaries and keep the blood moving through them. Only in them is there exchange between the blood and the tissue fluid surrounding the body cells. The diameter of the capillaries is only $1/3,000$ inch even when moderately distended, and their walls are only $1/30,000$ inch in thickness, being formed of flat, scale-like cells. Blood flows through them with a pressure of about 7 ounces per square inch. Their thin walls are not broken by this pressure because the intercellular fluid which bathes them is under an approximately equal pressure. The walls are permeable, somewhat like filter paper. Substances in solution go through them and so the strength of solutions inside and outside them tends to be equalized. However, they help some solutions to pass and hinder others: They regulate the passage of colloids. White blood cells worm their way out through small holes between the cells and the holes close up after them. Fine nerves go to the walls of capillaries and nerve stimuli can make them contract. Further, small spider-like cells appear on some of them, sending processes around them. On occasion, these processes contract and may thus close the capillary entirely. (See also CAPILLARIES.)

The Arteries. The arteries lead from the heart to the capillaries. Two leave the heart, the pulmonary artery carrying carbonated blood to the capillaries of the lungs and the aorta carrying oxygenated blood, going to all other capillaries. There is a pulmonary circulation and a body circulation. Each of these arteries is like a tree trunk. It branches repeatedly into arteries of diminishing size till the terminal twigs join the capillaries. (See also ARTERY.) The pressure in the aorta is nearly 4 pounds per square inch, diminishing in smaller arteries to less than 1 pound. But it requires a pressure of more than 100 pounds a square inch to make large arteries burst when young and strong. The elastic fibers of the arterial walls give resiliency, making the blood flow steadily. The walls of arteries are always stretched during life by the blood pressure. Near the heart they have much elastic tissue in their walls. The aorta contracts nearly 30% of its length when released.

The AORTA is nearly 1 inch in diameter. It runs upward toward the neck from the heart and then turns backward in a loop. This course is a heritage: In fishes which have no lungs, the aorta went first to

the gills to oxygenate the blood, and thence to the rest of the body. In higher vertebrates, it starts toward the place where the gills were. In the limbs the arteries are in the best protected positions, because injuries of them are more promptly fatal than injuries of other parts.

The Veins. These tubes carry blood from the capillaries back to the heart. There are two sets of them corresponding with the two arterial systems: the pulmonary veins and the body veins. The pulmonary veins, 4 in number, carrying oxygenated blood from the lungs, empty into the left atrium; the latter, 2 in number, bearing carbonated blood from the body, empty it into the right atrium to be pumped to the lungs. (See VEINS.) The muscular coat regulates the blood flow. Most veins of medium size contain valves which permit flow only toward the heart. These are especially necessary in man, because the heart is so high above the feet. In a man standing up, the blood flow in veins from feet to heart is against gravity, but because of the numerous valves every body movement helps the venous return by making pressure on the veins. Inspiration also helps it greatly (see RESPIRATORY APPARATUS).

The veins usually accompany the arteries in the limbs, but there are large veins on the surface just under the skin. These furnish a free path for venous return when deeper veins are compressed by continued muscle action in the limb.

The Heart. The heart is the muscular pump which forces the blood on its ceaseless round. In conformity with the double circulation, pulmonary and general, the heart has two parts. On each side is a receiving chamber or atrium and a discharging chamber or ventricle. (See HEART, ANATOMY OF.) The blood comes in from the body through superior and inferior venae cavae into the right atrium. Thence it passes successively into right ventricle, pulmonary artery, lungs, pulmonary veins, left atrium, left ventricle, aorta, body arteries and capillaries, body veins back to the venae cavae again. Between the right atrium and right ventricle is the great tricuspid valve. Between the left atrium and the left ventricle is the bicuspid or mitral valve. Smaller valves, each with three semilunar cusps, are at the root of the aorta and of the pulmonary artery.

Each of the four chambers contains when filled $2\frac{1}{2}$ ounces of blood. The heart beats 70 times a minute and the contraction which is represented by the beat empties one chamber into the next. The valves prevent back flow. Muscle contraction lasts $3/10$ seconds, relaxation lasts $6/10$ seconds. The atria contract together, afterward the ventricles contract together. (See also PULSE.) The bundle of His is the connection. Atrial contraction is an advancing wave; ventricular contraction, because of this bundle, is general and the ventricles can empty at the top. The pressure produced in the left ventricle is necessarily higher than that in the aorta, namely 4 pounds per square inch. The atrioventricular valves have a difficult task for the size of the opening changes. The valve flaps are pre-

vented from being reversed by cords going to them from finger-like muscle projections inside the ventricles. The cords tighten when the pressure is high.

The heart beats rhythmically of itself, but its speed is regulated by automatic nervous control. It weighs 11 ounces in a young adult—considerably more in old age—for the elasticity diminishes in the arteries and more force is needed for the blood flow.

The beat is faster in small animals: mouse 700 per minute, rabbit 150, dog 110, woman 75, man 70, horse 44, elephant 27. In man at birth 140, infant 120, child 100, youth 90, and adult 70.

THE LYMPH VASCULAR SYSTEM

Lymph capillaries are present in most tissues. They are abundant in regions exposed to injury, such as palm, sole, and so forth, or in regions where absorption of fat occurs, as in the intestine. Scavenger cells can crawl into them and thus carry away the debris left by injuries, bacterial infections, or the natural death of cells. They are drained by lymph vessels, like small white veins, which converge toward the root of the neck, on the left side into the thoracic duct, on the right into the right lymphatic duct. These empty into veins of the thoracic inlet in which there is, during inspiration, negative pressure. Back flow during expiration is prevented by valves. There is very little pressure in lymph vessels. The lymph is secreted into them by the capillary walls and moved along partly by pressure of body movements on the valve-filled vessels. Some white blood cells (lymphocytes) are formed in lymph glands and every lymph vessel passes through at least one gland. This system furnishes a way by which lymphocytes can be gently floated into the blood vessels, notwithstanding the blood pressure.

The central nervous system has no lymphatics. It is not exposed to injury and its cells live through the body's lifetime. *See also* LYMPH; LYMPHATIC SYSTEM.

B. C. H. H.

VASSAL. *See* FEUDALISM.

VASSAR, MATTHEW (1792-1868), American philanthropist, was born in Norfolk, England, Apr. 29, 1792. When four years old he was brought to America by his father who established a brewery business at Poughkeepsie, and when 18 he entered the firm as a bookkeeper. The following year his father's business was destroyed by fire and Vassar then started a brewery of his own from which he made a large fortune. He was generous in contributing to various charities but his greatest philanthropy was the donation in 1861 of 200 acres of land and \$400,000 to found Vassar College. He died at Poughkeepsie, N.Y., June 24, 1868.

VASSAR COLLEGE, a non-sectarian institution for women, at Poughkeepsie, N.Y., was founded by MATTHEW VASSAR, a wealthy manufacturer, as "an institution which should accomplish for young women what our colleges are accomplishing for young men." He donated \$400,000 and 200 acres of land for the establishment of the institution, and by his will left

it another \$400,000. The institution was incorporated in 1861 as Vassar Female College. In 1867 the name of the institution was changed to Vassar College. The endowment fund of the college in 1931 was \$7,585,000. The library contained 171,133 volumes. In 1931-32 there were 1,143 students, and a faculty of 165, headed by HENRY N. MACCRACKEN.

VASSY, MASSACRE OF, a bloody skirmish which took place on Mar. 1, 1562, at a moment when Protestants and Catholics in France were already on the point of defending their religious beliefs with arms. The leader of the Catholic party, Francis, the Duke of Guise, was personally involved, for it was his military escort that drew sword upon a Protestant congregation worshipping in a barn near Vassy in Champagne. In the ensuing struggle more than 60 Protestants were killed and many were wounded. This massacre, which the Duke of Guise made no effort to stop, was the signal for the long and bloody wars of religion in France, which lasted with interruptions until the accession of Henry of Navarre to the throne at the end of the century.

VATA. *See* VAYU.

VATICAN, THE, while sometimes referred to as if it included the Church of St. Peter's and all the buildings and their precincts about the Piazza San Pietro in Rome, is strictly the name of the ancient *Palazzo Pontificio*, or Palace of the Popes. It is situated on the Vatican hill, which in ancient times never was included as part of the city and was not enclosed within the Aurelian Walls. Caligula had constructed a circus on this height and embellished it with a large obelisk from Heliopolis, which is the only monument of its kind in Rome that has never been overthrown, and which now stands in the center of the Piazza San Pietro where it was placed in 1586 under Pope Sixtus V. In the 1st century the site of the Vatican was the scene of Nero's races and the torture of the first Christians, including, according to tradition, the crucifixion of St. Peter, whose name was given to the church which was erected on the ancient walls of the circus. Around the church sprang up a number of chapels, monasteries, hospitals and, during the pontificate of Symmachus, 496-514, the first papal palace. Charlemagne is believed to have lived within it at the time of his visit to Rome. During the many disturbances in Rome in the course of the next six centuries, the building fell into decay, until in the middle of the 12th century the present building was started by St. Eugenius III and afterwards greatly enlarged by Nicholas III. But it did not become the regular residence of the Popes until after the return from Avignon in 1377, when the Lateran was deserted. It was Nicholas V who in 1450 began the task of making the basilica the largest and most imposing palace in the world. In 1473 Sixtus IV built within it the Sistine Chapel, and about 1490, Innocent VIII made the Belvedere or garden house. Later additions, including the building of the Library, were made by Bramante, under Julius II; the Pauline Chapel was built in 1534 under

Paul III, and under Urban VIII, the great staircase, the *Scala Regia*, was erected from Bernini's designs. The Vatican now includes several thousand halls, apartments, chapels, saloons and private rooms, the greater part of which are devoted to the exhibition of the papal treasures, objects of art and antiquities, while a comparatively small section is set apart for the papal court. The entrance is at the Portone di Bronzo, at the end of the right colonnade of the Piazza San Pietro, and is guarded by the famous Swiss Guards.

Art Treasures. Situated on the first floor, after ascending the *Scala Regia*, is the Sistine Chapel, 133 feet long and 45 feet wide, with its six windows on each side above. The lower part of the walls was formerly covered with Raphael's famous tapestries, probably the greatest art treasure of the Vatican, which after a tempestuous history, having been twice lost and twice found again, are now exhibited in the Galleria degli Arazzi. The 10 pieces, depicting scenes from the New Testament, were first made in 1516 at Brussels after cartoons by Raphael, who was paid 100 gold ducats for each, while Peter van Alst, the tapestry artist, received for each 1,500 of the same coin. The upper walls with the exception of the altar wall, are decorated with frescoes of the Florentine masters of the 15th century. While the chapel is full of art treasures of priceless worth, the chief object, since the loss of the *Sistine Madonna* by Raphael, is the famous altar wall painting of *The Last Judgment*, by Michelangelo, 64 feet in length, completed under Pope Paul III in 1541, and containing about 300 figures. The nudity of some of the figures caused the Pope to condemn the work, and Paul IV contemplated its destruction on this account, but was persuaded instead, to cause some of the figures to be draped by Daniele da Volterra, while Clement XII had Stefano Pozzi later drape others.

The valuable paintings of the Vatican can be seen, not only in the Sistine Chapel, but in Raphael's Stanze and Loggie, the Pauline Chapel, the Sala Regia, the Sala Ducale, the Stanza dell' Incendio, the Stanza della Segnatura, the Stanza d'Eliodoro, the Sala di Constantino, the Chapel of Nicholas V, and in the Picture Gallery, founded by Pope Pius VII for pictures restored by the French in 1815, most of which had been taken from churches. A large part of these collections were transferred in 1932 to the new art gallery erected in Vatican City by Pius XI, near the Observatory in the Vatican Gardens. Among the thousands of treasures within these halls may be mentioned Botticelli's *Temptation of Christ*, Perugino's *Christ Giving the Keys to Peter*, the ceiling of the Sistine Chapel begun by Michelangelo, the frescoes of Raphael in the papal apartments, executed by the order of Julius II and Leo X, and considered the finest work of this master, and his *Conflagration of the Borgo* in the room of that name. The first works of Raphael, begun when he was 25 years of age, can be seen in the frescoes of the Stanza della Segnatura, while others are in the Stanza d'Eliodoro. The

Chapel of Nicholas V was decorated by Fra Angelico da Fiesole in 1447 with frescoes from the lives of St. Lawrence and St. Stephen, which represent some of his finest work. Raphael's last great work, *The Transfiguration*, painted for Clement VII, can be seen in the picture gallery of Pius VII, with notable works by Murillo, Fra Angelico, Bellini and others, such as Titian's famous *Madonna of S. Nicolo de Frari*.

The antiquities of the Vatican are to be found in the Museo Pio Clementino, Museo Chiaramonti, Braccio Nuovo, in the Etruscan and Egyptian halls and their various galleries. Among the earliest treasures of this kind to be collected were the *Apollo Belvedere*, the Torso of Hercules and the famous Rhodian group in the Sala degli Animali, known as the *Laocoon*, which was discovered in 1506 and termed by Michelangelo "a marvel of art."

Library of the Vatican. The final point of interest is the Vatican Library, where the archives of the Church and the records of its relations with the various monarchs and potentates of the earth have been preserved. Many documents, first preserved in the Lateran, were lost by the migration to Avignon; but each Pope has increased the collection and the number of such has been augmented from time to time with gifts from nations and individuals, two of the most notable of the latter being the gift by the Elector Maximilian in 1623 of the *Bibliotheca Palatina* of Heidelberg, and the *Bibliotheca Reginensis*, which was the property of Queen Christina of Sweden. The collection of manuscripts, about 50,000 in number, cannot be duplicated elsewhere. It includes among many other treasures, a 5th century manuscript of the New Testament, a 5th century Virgil, a 4th century Terence, and autographs of Tasso and Petrarch. Henry VIII of England is represented by his *Defense of the Seven Sacraments* with an autograph signature of the King. Martin Luther's autographed letter of 1535 is preserved in the same room with the love letters of Anne Boleyn and the letters and poems of Michelangelo. In addition to its mss., the library contains over 6,000 incunabula, about 700,000 prints and engravings, more than 250,000 books, a collection of medals and coins upwards of 85,000 in number and a museum of Christian antiquities, first assembled by Benedict XIV and containing articles from the Catacombs. The building of the library was begun in 1587 and finished in 1589. Additions were made in 1610 under Paul V, and under his successors until the beginning of the present century, when Leo XIII and Pius X completed the Barberini Hall and finished it with the same artistic furnishings that were in the Barberini Palace in the 17th century.

Central Authority of Church. Finally, the Vatican is the administrative business center of the Roman Catholic Church and the office of the papal Secretary of State; from it the Pontiff, held by that Church to be the pastor and teacher of all Christians, governs the Church throughout the world. The administration of the Church is carried on by a num-

ber of permanent commissions or ministries called Sacred Congregations, composed chiefly of cardinals. The sessions of these congregations are held in the Vatican, and with the promulgations of the Pope, their decisions give an institutional character to the term Vatican which is understood throughout the world to be synonymous with the Catholic Church.

VATICAN CITY, STATE OF, the name of the sovereign papal state established by the Lateran Treaty of 1929, negotiated between the Italian government and the Holy See. It was signed on Feb. 11 by Premier Benito Mussolini and Cardinal Gasparri, Papal Secretary of State, and ratified June 7, 1929 (*see ITALY: History*). At the conclusion of the Treaty an Italian ambassador was immediately sent to the Holy See, and Pope Pius XI appointed an apostolic nuncio for Italy. The tiny neutral state thus constituted, comprising in all about 160 acres, consists chiefly of Vatican City. The extraterritorial possessions include several papal palaces in Rome given over to the business of the Holy See, and a few churches, notably St. John Lateran, St. Mary Major, and St. Paul's Outside the Walls.

Vatican City is situated on the low Vatican Hill, on the right bank of the Tiber in the northwestern part of Rome. It comprises a little more than 108 acres, and includes St. PETER'S CHURCH with its broad piazza, surrounded by two semi-circular colonnades, and the adjoining Vatican Palace and gardens. Within the gardens are the Vatican Astronomical Observatory, the printing offices, where the official organ *L'Osservatore Romano* is now published, and various administrative and residential buildings. These include the barracks of the papal gendarmes, who number about 120. The Swiss Guards, who date back to 1505 and whose picturesque costume is said to have been designed by Michelangelo, number 100. They guard the palace and preserve order among the multitudes of pilgrims who visit the pope. In addition the papal forces include two volunteer corps, the Noble Guard and the Palatine Guard—in all about 600 men. The population of Vatican City, which includes besides actual residents the Roman cardinals, numbers slightly over 700. The State of Vatican City has its own flag, white and yellow, divided vertically into equal parts, its own currency, stamps, wireless and radio facilities, and a railroad station. A railway only about 600 meters long, built chiefly to transport freight and building materials, runs from behind St. Peter's to the station.

Government and Administration. The State of Vatican City is under the direct control of the pope. Assisting him are the Papal Secretary of State, the Governor of Vatican City, and various other officials. The State is financed by the contributions of the faithful, known as Peter's Pence, and by the interest on the indemnity paid by the Italian government in 1929 for the seizure in 1870 of the Papal States, consisting of 750,000,000 lire and an additional 1,000,000,000 lire in Italian 5% bonds. The Vatican is the

legal seat of the Sacred College of Cardinals and also of the Roman Congregations, the organs for the administration of the Catholic Church. The Rota, a tribunal dealing with ecclesiastical law, transacts its business in Vatican City, as does the tribunal of the Segnatura, a sort of supreme court of appeal from the decisions of the Rota. The foreign affairs of Vatican City are handled by the Secretariat of State, controlled by the Cardinal Secretary of State. The diplomatic service includes the Papal nuncios, in 1929 maintained by the Vatican in 30 countries. In other countries Apostolic delegations are appointed to deal with the bishops.

Papal Court and Household. The Papal Court consists of the Pontifical Chapel, including the Roman cardinals and certain privileged bishops, and the Papal Household, including the Secretary of State, the two "cardinals Palatine," the prelates of the papal antichamber, domestic prelates, distinguished laymen honored by the pope, and officers of the Swiss, Noble, and Palatine guards. Papal ceremonies are attended by the diplomatic corps as well as the Roman nobility. During the vacancy of the Holy See the Vatican witnesses the deliberations of the conclave to elect a new pope, the voting being done in the Sistine Chapel. Coronation of the popes takes place in St. Peter's. All Catholic bishops are required to pay periodical visits to the pope.

VATICAN COUNCIL, an ecumenical or general council of the Roman Catholic Church, summoned by Pope Pius IX to meet in 1869 and 1870 at Rome. At this council, there was promulgated the doctrine of Papal INFALLIBILITY.

VATTER, LAKE. *See WETTER.*

VAUBAN, SÉBASTIEN LE PRESTRE, SEIGNEUR DE (1633-1707), French marshal and military engineer, was born at St. Leger de Towcherets, Burgundy, May 1, 1633. He entered the French army at the age of 17, and quickly became known for his skill in the construction of fortifications, and for his courage in action at Oudenarde, Valenciennes, and Cambrai. In 1655 he was appointed royal engineer to Louis XIV, and set about fortifying 300 French towns, in most cases employing the system of approach by parallels. He was made governor of the Lille citadel in 1677, and was commanding officer at numerous sieges. In 1703 he was created a Marshal of France, in part recognition of his fortifications of Lille, Metz, Dunkirk, and Strassburg, and for his invention of ricochet fire. Vauban died at Paris, Mar. 30, 1707.

VAUDEVILLE, a word used in the United States to describe the program of acrobatics, dances, songs, monologues and dramatic sketches staged successively at one performance. In this sense the word is an American colloquialism, but the performances in this country bear a resemblance to the "variety theater" and music-hall entertainment of England, and to the *cirque intime* common in France, Germany and Russia (*see CIRCUS*).

Continental vaudeville has a venerable history. The

characteristic intimacy of this form of entertainment doubtless had its origin in the *TROUBADOURS* who flourished in the 12th to 14th centuries, and most etymologists place the birth of the word in the following century. In that century there lived in the valleys (French *vaux*) near Vire, in Normandy, a fuller named Olivier Basselin, who devoted his leisure to writing songs. In 1610 some of Basselin's informal ballads were collected by a lawyer named Jean le Houx, and published as the *Vaux de Vire*, whence probably came the corrupted word, vaudeville. About the beginning of the 18th century the term was used to describe not only street songs, but the topical ditties and lampoons inserted into plays. Beaumarchais's *Marriage of Figaro*, produced in 1784, concludes with a *vaudeville final*, in which all the characters in turn sing one verse of a song. In the 19th century vaudeville attained the status of a distinct department in the theater. In Paris the Théâtre du Vaudeville staged sketches written by the leading dramatists, feuilletonists and critics of the day, among whom were EUGÈNE SCRIBE (1791-1861) and Antoine Desaugiers (1772-1827). The informality of these presentations and the vein of robust wit and social criticism in which the sketches were often written, brought an increasing patronage to the vaudeville theater. The evolution of this entertainment from the aforementioned stage to the present-day *cirque intime* of the Continent, the English music-hall "turns," and the vaudeville of the United States is a natural expression of changing tastes.

In the United States vaudeville became a more elaborate dramatic representation due chiefly to the ideas of the late B. F. Keith. Previous to 1883, when the first Keith Theatre opened in Boston, and a definite appeal was made for the patronage of women and children, "variety" was directed principally to a male clientele. As early as 1865, TONY PASTOR, then a budding variety artist, made a successful effort to win over the "female" contingent. Records do not show the first use of the word "vaudeville" in this country, but in the programme of the Vauxhall Gardens of New York, dated Aug. 1, 1842, the term was already in use. Dr. George C. D. Odell, in *Annals of the New York Stage*, details this gradual evolution. The name vaudeville, however, did not refer to that class of entertainment as it is known to-day. The next recorded use of the word was by Tony Pastor, who in 1877 advertised "The Society Vaudeville Theatre of the Metropolis—585 Broadway." In 1881 Tony Pastor moved to Fourteenth Street. Among the stars he presented in his vaudeville performances were Lillian Russell, Evans & Hoey, Harrigan & Hart, the French Sisters, May and Flo Irwin, and Joseph Cawthorne.

But American vaudeville proper had its real beginning in 1883 in Boston, Mass., where a former circus performer opened a small museum and show next to the old Adams House in Washington Street. This man was Benjamin Franklin Keith (1846-1911), who had already had extensive experience with the old-fashioned variety shows. He called his first theater

the Gaiety Museum, and its principal attractions were Baby Alice, a midget weighing one and a half pounds, and an ancient (stuffed) "Mermaid" which had formerly belonged to the P. T. Barnum museum. In 1884 he enlarged his theater, using the second floor as a museum section and building a small stage in the store below for variety performances. Added attractions at this time were "The Circassian Beauties," a chicken with a human face, and two young comedians who performed as a team named Weber and Fields.

Determined to preserve the general plan of the variety show and at the same time lend it refinement, Keith sought the best available stage talent, established strict rules against all forms of vulgarity on the stage, encouraged women and children to patronize his small theater, and advertised his show as "vaudeville." The price of admission was ten cents. He devised the idea of continuous performances, and soon was able to pay his performers more money than they had been receiving in variety. In 1885 Keith was joined by Edward F. Albee. To stimulate business they organized the Gaiety Opera Company for the presentation of the new Gilbert and Sullivan light operas. The company was composed of unemployed church and opera singers who gave as many as ten performances between 11 A.M. and midnight.

In 1886, the first link in what has become one of the largest circuits of theaters in the world was added to the parent Boston house. This was the old museum in Providence which was leased and transformed into a first-class theater. A few years later Keith purchased the old Low's Opera House in Providence and converted it into a Keith vaudeville house. In that same year, 1886, he also took over the Bijou Theatre in Boston, which proved highly successful. In Philadelphia Keith built a modern theater and named it the Bijou. With four flourishing houses at his command, it was now possible to offer longer engagements and higher salaries to reputable artists. Thus the best class of talent became identified with vaudeville.

Among the early-day variety favorites who became identified with vaudeville were the Four Cohans, of whom George M. Cohan was a member, Montgomery and Stone, and David Warfield. The leading singers of opera in Europe also appeared.

The attitude toward vaudeville of the artists of the legitimate stage began to change as Keith and Albee raised the tone of the old variety theater. Maurice Barrymore was one of the early stars of the American stage to embark in vaudeville. Ethel, Lionel and John Barrymore have also appeared on the "big circuit," as have also Sarah Bernhardt, Lenore Ulric, Naimova, and William Faversham.

In 1891, encouraged by their success, Keith and Albee decided to build in Boston a theater second to none. The structure cost nearly \$700,000, and was described as the most magnificent playhouse in the world. In 1893, Keith decided to launch vaudeville in New York. The firm acquired the Union Square Theatre, and opened in the summer of 1893. Among

the first "headliners" to appear at Keith's Union Square were David Warfield, Clara Morris, John Mason and Marion Manola, and Mr. and Mrs. Sidney Drew. In 1900, the site for a Keith theater to cost \$1,000,000 was purchased in Philadelphia. The theater opened the following year. Soon afterward theaters were acquired or constructed in Columbus, O., Portland, Me., Cincinnati, O., Indianapolis, Ind., Louisville, Ky., and Cleveland, O. In 1912 eight vaudeville and stock theaters in Greater New York were purchased from Percy Williams and added to the Keith circuit.

The success of vaudeville in the east found ready imitators elsewhere in the country. Kohl and Middleton in Chicago as early as 1886 seized upon the Keith idea. The same year Gustave Walters opened the Orpheum Theatre in San Francisco and launched in the west a vaudeville circuit which later merged with the Keith-Albee organization. F. F. Proctor, manager in New York of the Twenty-third Street Theatre, a legitimate house, changed his policy to continuous vaudeville in 1893. John J. Murdock opened the Masonic Temple Roof as a vaudeville theater in 1898. Oscar Hammerstein made his Victoria Theatre, New York City, a vaudeville house in 1899. Alex Pantages founded his Northwest Vaudeville circuit in 1900. F. F. Proctor opened the Fifth Avenue Theatre (formerly Miner's) in 1900. Gus Sun started a new Ohio circuit in 1905. In the same year the Keith and Proctor interests joined forces to establish the United Booking Office, which became the official clearing house and engagement bureau for the employment and booking of vaudeville artists.

The merger in 1927-28 of the two major circuits—Keith-Albee in the east and the Orpheum in the west—with the simultaneous absorption of some of the foremost motion picture producing companies, was one of the inevitable developments of American big business. Since then vaudeville has envisaged the possibilities of the new era of entertainment opened by the advent of the radio and television. With ample facilities for the presentation of motion pictures, the vaudeville programs in most cases became divided between vaudeville and sound pictures. By means of the merger of the major vaudeville interests, the industry represented by this type of entertainment added to its resources a vast picture-producing unit. *See also* MOTION PICTURES.

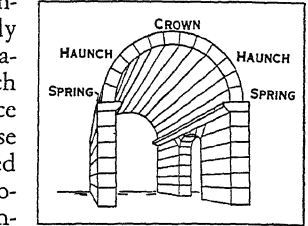
M. A. L.

VAUGHAN, HENRY (1622-95), Welsh poet and mystic, surnamed "the Silurist," from the Silures, the ancient people of South Wales, was born Apr. 17, 1622, in Brecknockshire. He was probably educated at Jesus College, Oxford, and later practiced medicine. When 24 years of age he published *Poems, with the Tenth Satire of Juvenal Englished*, and in 1651, a friend, without his consent, published *Olor Iscanus* or *The Swan of Usk*. At this period Vaughan suffered a severe illness, and all his writings afterward show a deep religious character. His best known work, *Silex Scintillans*, or *Sparks from the Flint*, appeared in 1650, and consists of short religious poems in a

quaintly artificial style. "The Retreat" in this volume is said to have suggested to WILLIAM WORDSWORTH his *Ode on the Intimations of Immortality*. The prose works of Vaughan include *Flores Solitudinis* and *The Mount of Olives*, both works of religious meditation. He died in Brecknockshire, Wales, Apr. 23, 1695.

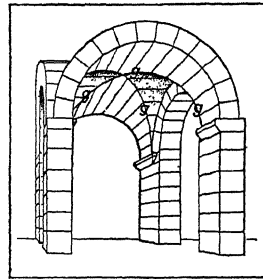
VAULT, any curved roof or ceiling over a room or enclosed space built according to the principle of the ARCH, that is, of an assemblage of approximately wedge-shaped pieces of material so arranged that each supports and locks in place the others. Even those roofs or ceilings of curved shape, built of a homogeneous material like concrete, may be analytically considered as arches, and are thus true vaults. More loosely, any ceiling or roof of a similar curved shape is often called a vault, however constructed.

Vaults are usually classified according to their shape and structure, as follows: *Barrel* or *tunnel vault*, one whose curvature is constant and unbroken throughout its length, like a tunnel, a simple continuous arch. *Groined vault*, one formed by the intersection of two barrel vaults crossing each other at an angle in such a way as to form arches at the walls, and concentrate all the load at the corners made by the intersection. *Cloistered vault*, the exact opposite of the groined



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BARREL VAULT



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GROINED VAULT
g, g, Groins

vault, also formed by the intersection of two barrel vaults, but in the reverse sense, so that the vault surfaces rise equally from the sides of the vaulted area and meet the walls in a level line. Cloistered vaults may be square or polygonal, and are sometimes called square or polygonal domes. *Dome*, a vault of hemispherical or semi-ovoidal shape. A *pendentive dome* is a vault of spherical shape

over a square or polygonal room, intersecting the walls in circular curves. *Pendentive*, a triangular section of a sphere filling the upper corners of a square or polygonal room, in order to form a circle at the top on which a dome can be built. (*See PENDENTIVE.*) *Ribbed vault*, one in which the surface is broken up by projecting arch ribs, placed either to strengthen and support the vault, or to add to its decorative effect. *Groin*, the intersection between any two intersecting vault surfaces. Where the vaults are circular in section, and equal in height and span, the groin forms an ellipse.

Origins. Domes seem to have been invented early in connection with the building of circular huts in

sun-dried brick. They received an especially important development in west central Asia, as in the Mesopotamian valley and the Iranian regions. Huts so vaulted are shown as characteristic features of village buildings by many Assyrian palace reliefs of the 8th century B.C. The skillful Chaldaean builders of the Sumerian lower valley also early used the barrel vault; tombs of the 4th millennium B.C. were sometimes barrel-vaulted. The later Assyrians used the same form as an important feature in palace design, in monumental gateways, and probably also in the typical long narrow halls. Vault-building apparently remained an important factor in the building of these countries for centuries, and many competent authorities, notably J. Strzygowski, find in Central Asia the great inspiration behind Roman and medieval vaulting. For the contrary theory, which finds the origin in Etruria and Rome, see G. T. Rivoira, *Roman Architecture*, 1925.

Another possible source of vault building lies in such Neolithic buildings as the Sardinian *nuraghi* and other early structures of beehive type like the Aegean *tholos* tombs. These are all roofed with corbeled vaults, that is, by means of stones laid in horizontal courses, each one of which projects inward slightly beyond the one below. By tilting the courses so that they leaned inward, much smaller stones were required, and a true vault resulted. Various early Etruscan tombs show apparently transitional types, such as the 6th century B.C. *crocefisso del tufo* from Orvieto and now in Florence. By the 4th century B.C. the complete cut stone barrel vault was used, as in the tomb of the Tlesnei from Chianciano, now also in Florence.

The Egyptians also knew and used vault forms at a very early period, though they made little use of the idea in monumental work. The Greeks, similarly, seem to have known the vault though they used it little. Only in Asia Minor and in the Hellenistic period was an architectural feature made of the vault in city gates.

Roman Vaults. The Romans erected the crude Etruscan tradition of vault building into one of their major building techniques. This advance resulted from two things: first, the discovery or invention of intersecting vaults, and, second, the building of vaults in brick or concrete instead of cut stone. The first allowed the support of large vaults on isolated masses; the second made the building of large inexpensive vaults possible. All vaults, like all arches, exert side thrusts. In massive building in cut stone where vault spans are small and the barrel vault is used, the heaviness of the structure is likely to withstand the distributed thrust. With groined vaults of large size, however, where the thrusts are concentrated at the supports, special provision had to be made. The essence of much Roman planning is to be found in this necessity; the buttresses again and again are brilliantly combined in the basic conception of the building and made to add to its usefulness as well as to its beauty. The earliest intersecting vaults are probably those of

the Tabularium at Rome, built about 80 B.C., and are of the cloistered type. The Augustan Age knew the dome, half-dome, and barrel vault as well, and also probably the groined vault, which came into common use by the middle of the 1st century.

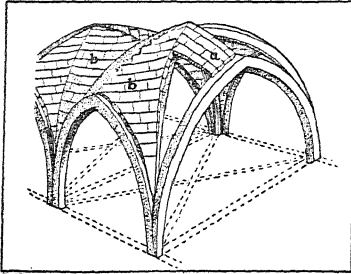
Another vault quality which led to important consequences was the necessity for centering to support it until it was complete. The Chaldaeans and Assyrians had developed ways of building small vaults without centering, by inclining the brick courses so that each supported the next. The large size of the Roman vaults made any such expedient impossible. They therefore began to divide up large vaults into small areas by structural ribs, as in the Colosseum, and also invented a method by which a complete vault of thin light tiles, easy to support, was first built, and served itself as the centering for the main mass of the vault. In the search for vault perfection, vaults were made lighter and thinner, strengthened with ribs and built-in arches; and constantly wider and higher spaces were vaulted. This development lasted well into the 4th century. Characteristic examples are: the throne room of the Palace of Domitian, the imperial *thermae* (see BATHS), the dome of the Pantheon, the Basilica of Constantine. See ROMAN ARCHITECTURE.

The East. Meanwhile Roman Syria, and Parthia and Persia outside the Empire, were creating their own types of vaults, Syria in stone, and Persia in brick. It was the Parthians and Sassanians who in their great palaces as Firouzabad of possibly the 4th century, and Ctesiphon, 6th century, were attacking the problem of putting a dome on a square plan, which the Romans had never solved, and also were building barrel vaults of large span with pointed and horseshoe sections. The union of Roman planning genius with the eastern vault produced the vaulted monuments of BYZANTINE ARCHITECTURE, and led to the invention of the pendentive, and later of the dome on a drum, and all the infinite variety of groined and pendentive vaults that are one of its chief accomplishments.

The same Iranian vault tradition, touched often with the later Byzantine skill, lay behind the development of vaults in MOHAMMEDAN ARCHITECTURE. In Turkey the Byzantine influence is manifestly dominant, and few domical buildings are as logical, as carefully composed, and as daring as the mosques of Constantinople. In Arabia, Syria, Egypt and the Moorish dominions it is the Persian influence that is supreme. The Moguls carried Persian skill to new heights both structurally and aesthetically; the Taj Mahal at Agra has a fairylike delicacy beyond any Persian example; and the great tomb of Mahmoud at Bijapur, where a room some 140 feet square is covered by an enormous dome supported on eight intersecting arches, is a structural masterpiece.

Romanesque Vaults. The builders of basilican churches in Europe struggled for 600 years with the problem of building satisfactory nave vaults. The simplest was the barrel vault. Yet the continuous thrust of such a vault high in the air was a serious problem. Enormously thick walls were necessary, or,

in some cases, such as St. Sernin in Toulouse, a vaulted gallery above the side aisle to buttress the central vault; but this prevented the use of clerestory windows and made a dark church. Furthermore, centering was a problem. Dividing the vault by cross ribs helped the centering problem; using groined in-

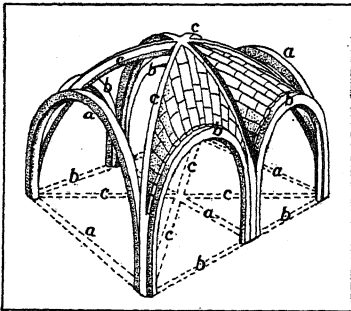


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LONGMANS, GREEN

GROINED RIBBED VAULT
a, French type. b, English type with zigzag
ridge joints

stead of barrel vaults allowed clerestory lighting. At various places, especially in southwestern France, an attempt was made, following eastern influence, to use a succession of domes over the nave, supported on pointed arches, but this broke up the unity of the whole.

The final answer was first approximated by the Lombards in the complete ribbed groined vault, with ribs under the groins as well as straight across from pier to pier. This system was later elaborated by the Normans, both in France and England; Durham Cathedral nave has a highly developed ribbed groined vault completed as early as 1133. One Norman in-



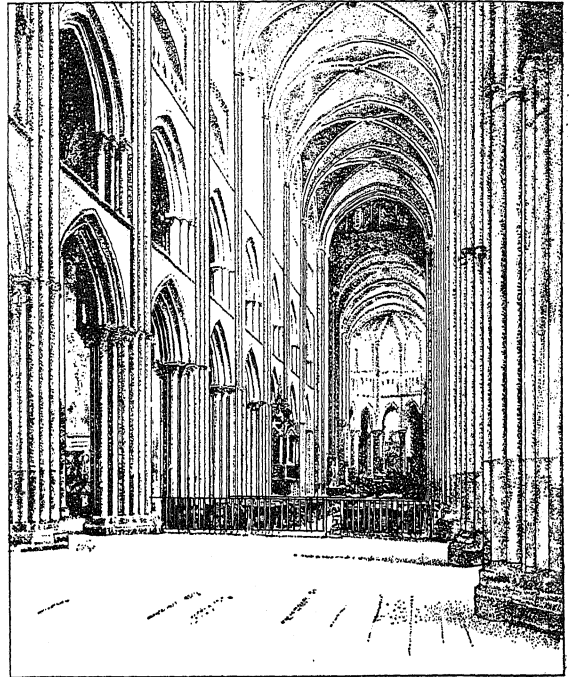
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LONGMANS, GREEN

SIX-PART RIBBED VAULT
a, a, Transverse ribs (*doublaux*); b, b,
wall-ribs (*formerets*); c, c, groin-ribs (*diag-
naux*). Two compartments with the fillings
complete are shown. All the ribs are semi-
circles

novation of importance was the six-part vault. The Lombards, in order to obtain a square vaulting bay for the nave, had commonly combined two side aisle bays into one bay of the nave. In this case the weight of the nave vault came on alternate piers on both sides of the nave, and accordingly alternate piers were made heavier. The Normans kept this alternation, but evidently did not like the lack of unity in the vault ap-

pearance. They therefore built an additional cross rib over the nave on the intermediate, lighter piers, thus dividing the cross vaults into two. The two small vaults thus developed did not run at right angles to the nave, but obliquely, so that their four ridges met at one point, the intersection of the main diagonals. This type is called the six-part vault, and is common in early French Gothic Cathedrals, i.e., Laon, begun 1160; Notre Dame, Paris, begun 1163. Norman 12th century examples are found in the Abbaye aux Hommes and the Abbaye aux Dames in Caen, the latter showing an interesting transitional variant. See ROMANESQUE ARCHITECTURE.

Gothic Vaults. The complete solution of the problem of the vaulted basilica was reached only by



ROUEN CATHEDRAL

View of 13th century Gothic nave, looking east, showing 4-part
vault

the adoption of flying buttresses and the pointed arch. The flying buttress allowed vaults of great height with large clerestory windows; the pointed arches could be built of various heights and so be combined harmoniously despite the varying widths of cross arch, wall arch, and diagonal arch. They also solved the difficult problem of the ambulatory vault around an apse; with them, bays of any shape or number of sides could at last be satisfactorily vaulted. See GOTHIC ARCHITECTURE.

In building the filling web between the vault ribs, the French used stones of varying width whose joints were always parallel to the vault ridge. The English, though they first learned Gothic vaulting from the French, soon worked out a different system, with stones of uniform width, which, owing to the curvature of the surface, met at the ridge in an awkward

herringbone line. To cover this joint, they soon came to use ridge ribs, and these may have suggested to them the possibility of using other intermediate ribs as well. Intermediate ribs, called tiercerons, were placed between the cross rib and the groin rib, and between the groin rib and the wall rib. A great development of these extra ribs characterized the Decorated Period of English Gothic. Lincoln (the Angel Choir) and Exeter cathedrals show the richness of effect thus produced. In the 14th century further short ribs called liernes were added, running over the vault surface and tying together ridge, groin and tierceron ribs; decorated bosses marked the intersections, and the results were called net vaults or star vaults according to the pattern formed. Gloucester choir, 1377, is a good example.

The webs of such a vault are so small that it is only a slight step to cutting them on the same stones as the ribs; the Gothic idea of the ribbed vault thus disappears, and the ribs exist merely as decorations on a cut stone vault. At the same time, the shape of the surface was modified so that each severy, the portion supported on each pier, became conoidal in shape, like an inverted bell. The result was the fan vault so magnificently shown in the Henry VII Chapel, at Westminster Abbey, and King's College Chapel at Cambridge, both completed by 1515.

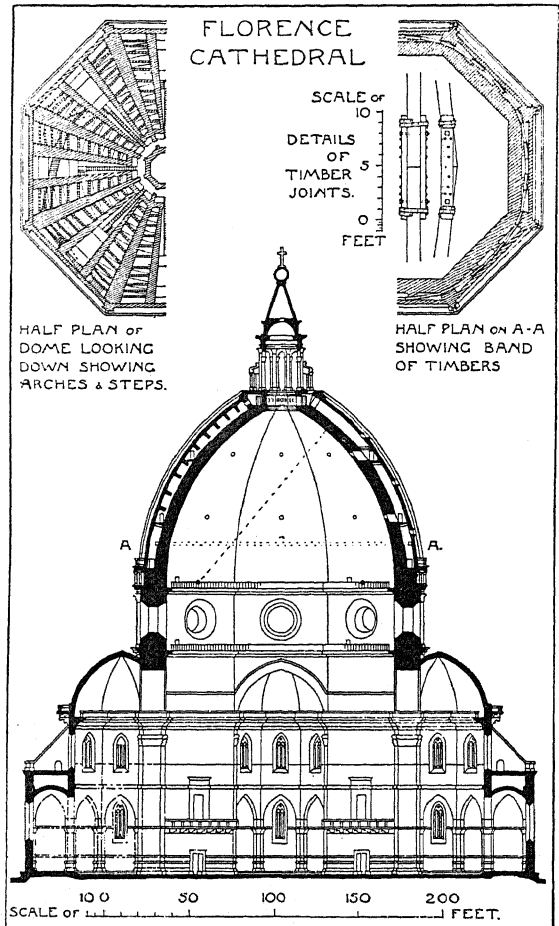
Elsewhere in Europe, vaults mainly followed French precedent during the Gothic period until the 15th century, when local variations, perhaps due to English influence, began to creep in. Especially in the late Gothic work of Germany and Spain, the most extravagant schemes occurred; intermediate ribs abounded, and, instead of being in a single plane, were waved and twisted fantastically. In Italy a continuing love of large scale parts led to totally different interior spatial effects.

Renaissance and Modern Vaults. The greatest Renaissance vault innovation was the tremendous development of the dome on a high drum set on pendentives. Brunelleschi's dome at Florence for the Cathedral, really an octagonal cloistered vault, set a fashion widely followed. It had chains of wood and iron built in to take the thrust, and it was in two shells, since different curves and different heights are often required for interior and exterior effect. Nearly all the great Renaissance domes which followed also had two or more shells. (See *DOME*.) Another Renaissance invention was the coved ceiling with penetrations, a semi-elliptical vault with small cross vaults, generally conical, penetrating it and swept up to pointed intersections. It was a favorite form because of the interesting areas for decoration it produced.

The two great advances of modern vault building are the scientific developments of tile and reinforced concrete vaults. It was discovered that light tiles could be laid to form vaults in much flatter curves than had been thought practical. These tile vaults, called after their maker and inventor, Guastavino vaults, have been extensively used in modern churches and public buildings; often the tiles are of a special

porous, sound absorbing nature in order to improve the usual bad acoustic quality of most vaulted surfaces.

The development of light reinforced concrete vaults of great beauty and strength was primarily a European development, and has enabled the creation of new forms for both monumental and practical uses. Parabolic and similar forms are common, as well as flat segmental shapes. Another modern invention is a vault formed of small pieces of wood framed together diagonally; it is light and rigid, and a true vault exerting thrust. Typical modern vaults are the fol-



FROM F. M. SIMPSON, A HISTORY OF ARCHITECTURAL DEVELOPMENT. LONGMANS, GREEN & CO.

POINTED DOME OF THE FLORENCE CATHEDRAL, ITALY

lowing: Chapel of Columbia University, New York, by Howells and Stokes, of tile; the Church of Notre Dame at Raincy, near Paris, by the Perret brothers, of concrete; the remarkable dirigible hangars at Arly, by Freyssinet and Limousin, of concrete; the Planetarium at Düsseldorf, by W. Kreis, of concrete; and the Danish Church, Berlin, by O. Bartning, of wood.

T. F. H.

VAULTS. See *SAFES*.

VAUVENARGUES, LUC DE CLAPIERS, MARQUIS DE (1715-47), French writer, was born at Aix, Provence, Aug. 6, 1715. Entering the army,

he fought in Italy and in Bohemia. He returned to France and tried, without success, to enter the diplomatic service, then turned to literature. Though his works were few, they made their mark, particularly the *Introduction à la connaissance de l'esprit humain*, published in 1746. Vauvenargues' keen insight and epigrammatic touch have caused him to be compared with LA BRUYÈRE. He died in Paris, May 28, 1747.

VAYU or **VATA**, in Hindu mythology, the personification of the wind, husband of Anjana and father of Hanuman.

VEAL, the flesh of calves, usually slaughtered when four to eight weeks old. The retail cuts are the loin, flank, leg, rump, shank, hotel rack or ribs, chuck, shoulder, neck and breast. "Bob veal" is the meat of calves less than three weeks old. Scientific investigations have disproved the popular theory that veal is harder to digest than mature beef.

BIBLIOGRAPHY.—W. H. Tomhave, *Meats and Meat Products*, 1925.

VEBLEN, THORSTEIN BUNDE (1857-1929), American economist, was born July 30, 1857. He taught in the department of political economy of the University of Chicago from 1892 until 1906 when he became associate professor of economics at Leland Stanford. In the period 1896-1905 he was managing editor of the *Journal of Political Economy*, in which he expressed many of his original conclusions in economics, and his grasp of the economic aspects of modern industry. In 1911 he went to the University of Missouri as lecturer in economics, and in 1918-27 taught at the New School for Social Research, New York City. His important writings include *Theory of the Leisure Class*, 1899, *The Vested Interests*, 1919, and *The Place of Science in Modern Civilization*, 1920. He died at Palo Alto, Calif., Aug. 3, 1929.

VECELLIO, TIZIANO. See **TITIAN**.

VECTOR ANALYSIS. See **SCIENCE**.

VECTOR MODEL. See **LINE SPECTRUM**.

VEDDER, ELIHU (1836-1923), American painter, was born in New York City, Feb. 26, 1836. He went to Europe in 1856 to study under Picot. After 4 years in Italy, he returned to the United States in 1861; he became a National Academician in 1865. During the Civil War Vedder painted *The Question of the Sphinx*, *The Fisherman and the Genii*, *The Roc's Egg* and *The Lair of the Sea Serpent*. The artist returned to Europe and spent the remainder of his life in Rome, with occasional visits to the United States. His illustrations for Fitzgerald's translation of the *Rubaiyat of Omar Khayyam*, published in 1884, won him world-wide renown. His murals include five panels in the Library of Congress, Washington, and one in Bowdoin College. The artist is represented in the Metropolitan, Brooklyn and Boston museums, and in the Carnegie Institute. Vedder died in Rome, Jan. 29, 1923.

VEDETTE or **VIDETTE**, a mounted SENTRY detached from a picket. Vedettes are part of the outpost system used to protect larger military forces in camp. They are usually the element nearest the

enemy, are posted in pairs, on the line of observation, individuals about 30 yards apart and pairs about 400 yards apart. They give warning of the approach of the enemy.

VEERY, a name often given to the Wilson's thrush (*Hylocichla fuscescens*), a common but very shy bird with a ringing somewhat flute-like song, inhabiting damp woodlands in eastern North America. See **THRUSH**.

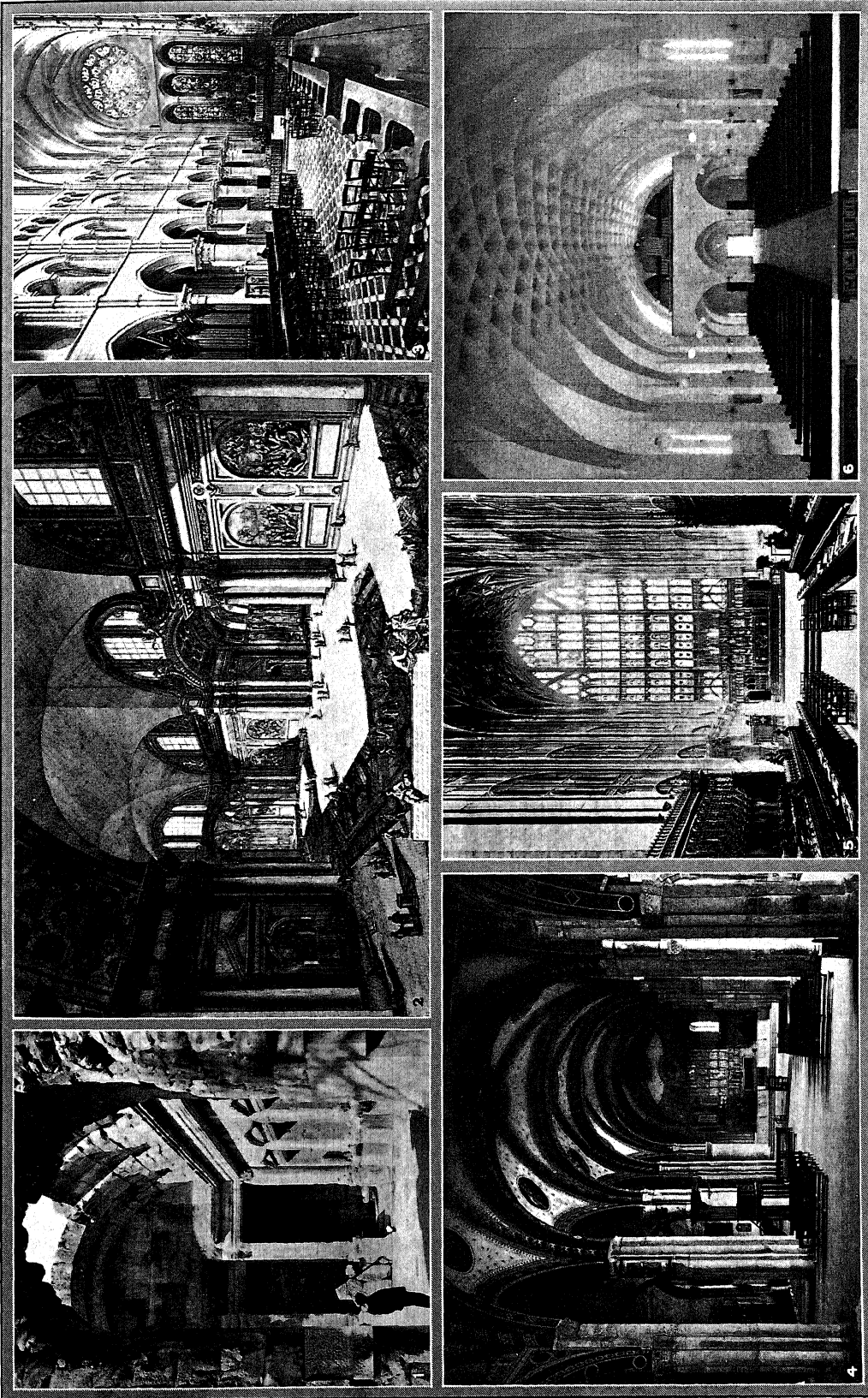
VEGA, GARCILASO DE LA (1503-36), Spanish hero and poet, was born at Toledo in 1503, of the highest aristocracy. He entered the royal bodyguard in his 18th year, distinguishing himself by his intrepidity in many battles. Later he was imprisoned on an island in the Danube, writing there a beautiful poem on the "divine river." His short life, crowded with travel and adventure, ended during the Provençal campaign of 1536, when, commanding a storming-party at Muy, with his usual spectacular courage he was mortally wounded. Vega's valor, charm and talent constitute him a national hero, and his few poems are of such perfection as to justify his title "prince of Spanish poets."

VEGA, GARCILASO DE LA, EL INCA (c. 1540-1616), Peruvian historian, born in Cuzco, son of Sebastian Garcilaso de la Vega, a Spanish conquistador, and of Chimpa Ocllo, the niece of the great Inca Huayna Ccapac. He traveled extensively in Peru studying the manners, customs, religion and economic life of the Incas and later embodied his studies in his history *The Royal Commentaries of the Yncas*. Owing to his knowledge of the Quechua language and the teachings received from his mother, this is the best account of the history of the Incas available. Though accused of exaggeration, he declared that he related only what was told him as true. He also wrote a *General History of Peru*, which is valuable for the period of the conquest, as he records the incidents told to him by his father, who was present. He died in 1616.

VEGA (*Alpha Lyrae*), the brightest star in the northern hemisphere. It is white in color, 26 light years distant, and 50 times more brilliant than the sun. See **STAR: map**.

VEGA CARPIO, LOPE FELIX DE (1562-1635), Spanish dramatist and poet, was born at Madrid, Nov. 25, 1562. At the age of five he read both Spanish and Latin, and would bribe his school-fellows with part of his breakfast to write down the verses he dictated. He was the prodigy of his Jesuit College, every accomplishment coming easily to him. When the Spanish Armada invaded England he was on board the *San Juan*, on which his brother was shot dead by his side. In 1614 he entered the church. He was the supreme head of Spanish literature, and a contemporary creed, later suppressed, began "I believe in Lope de Vega, the Almighty, the Poet of Heaven and Earth." His comedies, totaling at least 1,800, are full of dramatic power, originality and variety. He died at Madrid, Aug. 27, 1635, and was honored by a public funeral and national mourning.

VAULT



1. EWING GALLOWAY PHOTO; 2. FROM AN ENGRAVING BY GIOVANNI BAPTISTA PIRANESI; 6. COURTESY GERMAN TOURIST INFORMATION OFFICE

CHARACTERISTIC TYPES OF VAULTS, ANCIENT AND MODERN

1. Interior of the Temple or Nymphaeum of Diana, Nîmes, France.
2. Interior of the Baths of Diocletian, Rome, Italy, restored by Michelangelo as the Church of Santa Maria degli Angeli. 305-306.
3. Nave and choir of the Cathedral of Laón, France, showing 6-part vault. 12th century.
4. Interior of the basilica of Sant' Eustorgio, Milan, Italy, showing early ribbed vaults. 12th century.
5. Looking east from the choir of Gloucester Cathedral, England, showing elaborate lierne vault. 14th century.
6. Interior of the Memorial Church at New Ulm, Germany. 20th century.

VEGETABLE GROWING includes two general classes of plant culture; amateur gardening which supplies the home table, and commercial gardening which supplies the market. The latter is also of two distinct classes, market gardening in which vegetables in considerable variety are grown under intensive methods on costly land near market, and truck gardening in which few crops are grown in large areas on low priced land far from market. These classes overlap and also extend into general agriculture as when turnips are grown for stock feeding, or potatoes enter crop rotation. The factor most influential in broadening vegetable growing is land cost. Home gardeners are forced to use smaller areas than formerly and so must discard crops which are from their standpoint extravagant of space. Similarly market gardeners must move farther from the city and haul by truck instead of horse; and truckers can move to cheap southern land where earlier maturity, fast transportation and refrigerator service offset distance from market. See **HORTICULTURE**.

VEGETABLE IVORY, the exceedingly hard kernel of a nut produced by a small Central American palm (*Phytelephas Seemannii*). The seeds, borne in cell-like structures massed in thorny heads a foot or more in diameter, resemble greatly enlarged chestnuts. Like ivory, the solid, pure white or creamy-white flesh of the seed is used for making billiard balls, buttons, toys and numerous other articles.

VEGETABLE MARROW, a cultivated variety of the common pumpkin (*Cucurbita Pepo*), very popular as a table vegetable in Europe, especially in England, but little grown in America. The plant, which should be grown quickly in very rich soil, produces oblong, cylindrical fruits. These should be eaten when very young and tender, that is, when they have attained about $\frac{1}{8}$ or $\frac{1}{4}$ of their full size. When properly grown and cooked they possess a delicacy of flavor surpassed by few, if any, other vegetables.

VEGETABLE OILS, various viscous, soft, or semi-soft substances obtained from fruits and seeds which consist largely of fatty acids and their glycerine compounds. They are generally divided into the oils proper, which are liquid below 70° F., and the vegetable fats, still solid above 70° F. The oils proper are classified into drying, semi-drying, and non-drying oils, the former comprising linseed, hempseed and poppyseed oils, and deriving their drying properties from the presence of compounds of the unsaturated linoleic acid, which absorb the oxygen from the air and harden. For these reasons they are used for paints and varnishes, also for the manufacture of soap and linoleum. The semi-drying oils, such as those obtained from the soya bean, corn, sesame, cottonseed, and rape, possess the drying and hardening quality to less extent, and are widely used for food, for burning and lubricating purposes, in lamps and for soaps. Among the non-drying oils are those obtained from the almond, peanut and olive, used chiefly for edible, pharmaceutical, and lubricating purposes, as well as for soaps; and castor oil, used medicinally.

The vegetable fats, such as palm oil, coconut oil, palm-kernel oil, cocoa butter are used extensively as foods, and for the manufacture of soaps and candles. Vegetable oils are very largely and fats almost exclusively produced in warm countries, and are usually made from the fruit or the seed by crushing and pressing it, or boiling the pulp thus obtained with water. See also **OILS**. W. J. L.

VEGETABLE OYSTER, a name given to the **SALSIFY** because of the somewhat oyster-like flavor of the cooked fleshy root.

VEGETABLES. Commerce in fresh vegetables on the North American continent far exceeds that of the rest of the world, and has been developed chiefly since 1900. Fresh vegetables for the market were grown only near the place of consumption prior to the general introduction of the manufacture of ice. This invention made possible the use of refrigerator cars in warm regions where natural ice could not be had.

Since 1887 nearly every locality in the United States has been tried as a market gardening region. Many vegetables, formerly short season luxuries, are now abundant and cheap throughout the year. The increases in shipments within recent years of lettuce, celery, spinach and bunched vegetables are amazing. Lettuce is second only to potatoes in number of carloads moved.

Vegetable production is very important in Europe and in parts of Asia but long distance shipments are confined to North America. Potatoes rank first in importance to the inhabitants of the North Temperate zone. They are eaten by more white people than any other vegetable. Yields per acre and consumption per capita are greater in north European countries than in America. In the Southern states the sweet potato outranks the potato as the most important starchy vegetable. Related tropical roots are vital to the maintenance of native populations in the Philippines and Samoa. Potatoes, sweet potatoes and yams are considered competitive sources of starch in bulky form in the American diet.

Root crops, in American market parlance, include chiefly beets, turnips, rutabagas, carrots, parsnips, salsify and radishes. The use of radishes associates them closely with the salad crops. The others are cooked, usually by boiling, and are sources of starch with mineral salts. All of this group can be stored for winter use but most of them are shipped fresh and bunched by the Gulf states and California from December to June. Soup and vegetable canners use chiefly the mature northern grown stock.

Salad crops are eaten raw. Celery, lettuce, escarole, parsley, sweet anise, and water cress furnish the fresh green vegetation now considered so essential. Green onions, leeks and cucumbers, though widely different botanically, are similar in use.

Greens include asparagus, spinach, kale, mustard, dandelion, Brussels sprouts, Italian broccoli, Swiss chard, the tender tops of beets and turnips and some wild plants such as the shoots of poke. The collard of the Southern states and cabbage belong in this

group from the point of view of the dietitian. All of these are cooked by boiling the leaves or stems. They furnish bulk and mineral salts. Asparagus and spinach are canned extensively, and cabbage is preserved as kraut. Served as slaw it is a salad crop. Commerce in greens is extensive and growing rapidly. Even turnip greens are shipped by hundreds of carloads.

Squash, eggplant and peppers may be baked or fried. Of these vegetables only the fruit is edible. Cucumbers, pumpkins and tomatoes are also fruits although always classed commercially as vegetables. The tomato is grown most extensively and has the greatest variety of uses. Immense quantities are used raw the year round; extensive winter imports from Mexico, Cuba and the Bahamas supplement the home supply. Tomatoes, cucumbers and certain leafy types of lettuce are almost the only vegetables still extensively grown under glass in competition with southern field culture. The tomato is also the largest single product in the canned vegetable trade.

accused was notified anonymously to appear within a specified time. If present, his trial followed the customary legal procedure. Condemnation meant immediate execution. If the accused failed to appear sentence was passed in his absence, to be carried out at the first opportunity by any member of the Vehm. The importance of these courts dates from the late 12th century. Entire cities, and even the emperor Sigismund, joined the Vehm, which supplied the lack of an adequate court system. The organization was formally abolished in 1811.

VEILED PROPHET, THE, the founder of an Arabic sect in the 8th century and the hero of a poem by THOMAS MOORE, "The Veiled Prophet of Khorasan," 1817, in *Lalla Rookh*. He was a mysterious being, always veiled, who claimed to be a god.

VEIN, tabular or sheet-like mineral masses occupying, or associated with a fracture or set of fractures in the enclosing rocks. The veins are of later formation than the rocks, and are the result of the filling of fissures and pores, or the replacing of country rock,

VEGETABLES, COMMERCIAL PRODUCTION, U.S., 1919-29

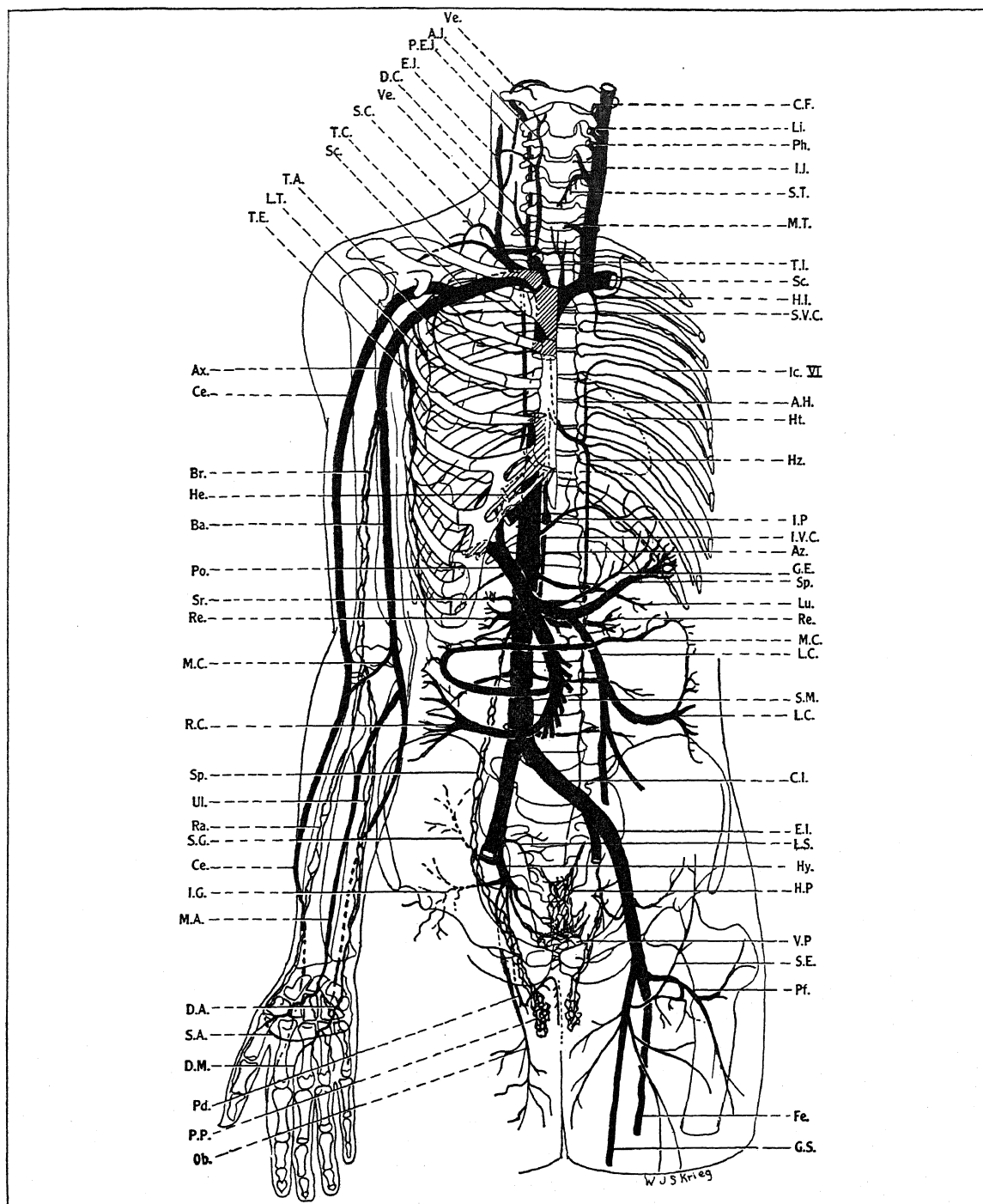
Item	1929	1919	Per Cent of Increase
United States, total acres	2,811,715	1,424,273	97.4
value of crop	\$295,962,373	\$189,770,549	56.0
Asparagus	99,230	30,219	228.4
value of crop	\$14,919,407	\$5,102,135	192.4
Beans (snap or string)	221,127	71,970	207.2
value of crop	\$20,903,908	\$8,031,449	160.3
Cabbages	178,657	123,994	44.1
value of crop	\$20,938,790	\$21,848,112	-4.2
Cantaloupes and muskmelons	128,677	78,436	64.1
value of crop	\$17,508,473	\$10,766,591	62.6
Celery	36,263	20,148	80.0
value of crop	\$17,707,091	\$9,462,277	87.1
Corn, sweet	483,053	271,584	77.9
value of crop	\$21,928,856	\$17,297,561	26.8
Lettuce	113,771	21,346	433.0
value of crop	\$20,603,759	\$8,535,092	141.4
Mixed vegetables	99,084	36,339	172.7
value of crop	\$17,388,400	\$8,154,177	113.2
Onions, dry	99,703	64,338	55.0
value of crop	\$17,085,627	\$21,387,221	-20.1
Peas, green	274,294	103,686	164.5
value of crop	\$15,297,967	\$7,164,988	113.5
Tomatoes	454,696	316,399	43.7
value of crop	\$53,247,599	\$38,675,496	37.7
Watermelons	290,879	159,088	82.8
value of crop	\$14,190,256	\$10,466,133	35.6

Peas, beans and corn are seeds, used while immature as vegetables. They are grown extensively as canning crops. Okra, artichokes and rhubarb serve special uses. W. A. S.

VEHMIC COURTS (*Vehmgerichte*), a system of popular courts in medieval Germany of early Westphalian origin, controlled by an organization known as the Vehm, to which any free man was eligible. They dealt with capital offenses, with heresy and witchcraft, and heard appeals from other German courts. Occasionally court sessions were secret; otherwise any free man might attend. Accusations could be brought only by a member of the Vehm. The

by the new minerals, or both. The term is usually applied to ore deposits, and refers to the gangue and ore which together make the vein. Ledge and reef are terms sometimes used for vein. *See also* LODE; ORE DEPOSITS.

VEINS, the system of tubes which carry blood from the CAPILLARIES back to the heart. (*See* CIRCULATION.) The wall of a vein is composed of the same three layers as that of an ARTERY, but the muscular layer is not nearly so heavily developed and the outer layer contains a smaller quantity of elastic fibers. The wall of a vein is considerably thinner than that of an artery of the same size.



THE PRINCIPAL NAMED VEINS OF THE HUMAN BODY PROJECTED ONTO AN OUTLINE OF THE SKELETON

A.H., accessory hemiazygous; A.J., anterior external jugular; Ax., axillary; Az., azygous; Ba., basilic; Br., brachial; Ce., cephalic; C.F., common facial; C.I., common iliac; D.A., deep palmar arch; D.C., deep cervical; E.I., external iliac; E.J., external jugular; Fe., femoral; G.E., gastro-epiploic; G.S., great saphenous; He., hepatic; H.I., highest intercostal; H.P., hemorrhoidal plexus and middle and inferior hemorrhoidal veins; Ht., outline of heart; Hy., hypogastric; Hz., hemiazygous; Ic. VI., sixth intercostal; I.G., inferior gluteal; I.J., internal jugular; I.P., inferior phrenic; I.V.C., inferior vena cava; L.C., left colic; Li., lingual; L.S., lateral sacral; L.T., lateral thoracic; Lu., lumbar; M.A., medial antibrachial; M.C., middle colic; M.T., middle thyroid; Ob., obturator; P.E.J., posterior external jugular; Pf., profunda femoris; Ph., pharyngeal; Pd., pudendal; D.M., dorsal metacarpal; Po., portal; P.P., pampiniform plexus; Ra., radial; R.C., right colic; Re., renal; S.A., superficial palmar arch; S.C., superficial cervical; Sc., subclavian; S.E., superficial epigastric; S.G., superior gluteal; S.M., superior mesenteric and intestinal tributaries; Sp., splenic; Sr., suprarenal; S.T., superior thyroid; S.V.C., superior vena cava; T.A., thoraco-acromial; T.C., transversus colli; T.E., thoraco-epigastric; T.I., thyroidea ima; Ul., ulnar; Ve., vertebral; V.P., vesical plexus

The veins returning blood from the lungs are termed the pulmonary veins, and empty into the left atrium or auricle of the HEART. All the other veins are termed systemic and flow into either the superior or inferior vena cava, which empty into the right atrium.

In general, veins accompany arteries, and are named similarly to the arteries they accompany. The superficial veins, however, tend to be quite large and do not accompany arteries of any size. Veins intercommunicate more than do arteries, which renders their anatomy more inconstant. The main channels are, however, quite constant in different individuals. Their course and names may be determined from an inspection of the accompanying figure.

The veins inside the cavity of the skull do not follow the courses of the arteries, and are termed sinuses. Of these, the superior sagittal and the two transverse sinuses are the largest. The transverse sinuses become the internal jugular veins on emerging from the skull. The blood of the face and scalp is collected into the external jugular veins. The two main superficial veins of the upper extremity are the cephalic and basilic. The deep veins of the upper extremity follow the course of the arteries and are usually double. The superficial veins join them at the shoulder. The jugular and subclavian veins unite to form the innominate veins of either side, which in turn join to form the superior vena cava.

The two main superficial veins of the lower extremity are the saphenous on the medial side, and the small saphenous on the back of the leg. The former joins the deep vein accompanying the artery at the groin, while the latter joins at the back of the knee. The deep veins of the lower extremity and pelvis correspond in name and position to the arteries: anterior and posterior tibial, popliteal, femoral, external iliac, hypogastric, and common iliac.

By the union of the common iliacs of either side, the inferior vena cava is formed, which ascends in front of the vertebral column at the right of the aorta.

The blood from the abdominal viscera is returned by the PORTAL VEIN, which presents certain peculiarities.

Pressure within the veins is much lower than that in the arteries, since but very little of the force with which the blood is pumped by the heart through the arteries is transmitted through the capillaries. Muscular action, together with the aid of flap-like valves, aids in returning the blood. W. J. S. K.

VELA (gen. *Velorum*), the sails, formerly a part of Argo, the ship, now an independent constellation containing a number of bright stars of the second and third magnitude. It lies to the east of Puppis and north of Carina. The two stars Delta and Kappa Velorum with Epsilon and Iota Carinae form a kite-shaped figure, resembling the southern cross. It is often called the false cross. *See STAR: map.*

VELASQUEZ, DIEGO RODRIGUEZ DE SILVA Y (1599-1660), Spanish painter, was born at

Seville in 1599. Velasquez, best known of Spanish painters, is essentially a painter's painter. For security of brush work and certainty of hand he has no equal. Every touch is right and seems to have been ordained so from the beginning. He is an extreme realist and his constant preoccupation was to give the facts of life as he saw them. In the very beginning his work had hardness but this soon melted into a flowing, easy manner that has been the envy of all modern artists. No other painter, with the possible exception of Frans Hals, has been so constantly held up as a model for other artists. It is true that in quite recent times there have been attempts to supplant him in the public favor with the works of El Greco, but it seems likely that so long as paintings are painted with a brush Velasquez will survive as the supreme technical expert. But the Velasquez fame is not based on technical prowess alone. Everything he did glows with life; and in addition, he was able to preserve to posterity a whole period of history when Spain was still splendid. During most of his life Velasquez was court painter to the gloomy Philip II, whose faithful friendship to the artist was one of his best points, and the long series of portraits of the royal family, great grandees and court servants is still the glory of the marvelous art collection in the Prado, the national museum, at Madrid.

Which is the finest of them it is difficult to say, but this honor is often given by artists to the immense canvas called *Las Meninas* or *The Maids of Honor*. This is a portrait of the young Infanta Margarita Maria, surrounded by her attendants, and it is incredibly life-like and touching. It used to be shown in an especially built room with a side-light which brought out the true qualities of the picture. It is now installed with less effect in the main gallery of the Prado. Another greatly admired work is the *Surrender at Breda*, in which Justin of Nassau is shown submitting to his conqueror, the Marquis di Spinola, with the troops in the background bearing their lances in a picturesque arrangement against the sky. But practically all of Velasquez' portraits are masterpieces. There is the one of Pope Innocent X which Sir Joshua Reynolds thought the greatest picture in Rome; the wonderful series portraying Philip II; the forceful painting of the sinister Olivares, minister of state; and the sympathetic studies of the court dwarfs and buffoons. One of the last compositions Velasquez painted, *The Weavers*, is also among the most admirable.

Velasquez had a quiet, dignified nature, and led a singularly serene, untroubled existence. With all his quietness he had a sure possession of character, and in spite of his journey of study to Rome and in spite of his association with the successful and worldly Rubens, he always remained essentially himself. His style is entirely his own, and better still, completely Spanish. The painter died at Madrid, Aug. 6, 1660. H. Mc. B.

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VELASQUEZ



"INFANTA MARIA THERESA"

By Diego Rodriguez de Silva y Velasquez (1599-1660). In the Imperial Gallery, Vienna.

VELES, also known as Koprulu and Kuprulu, a town of YUGOSLAVIA, in central Macedonia, situated on both banks of the Vardar River, about 25 mi. on the Belgrade-Salonika railway south of SKOPLJE. Veles was part of the Turkish vilayet of Skopje until 1912, when it was occupied by the Serbian army. In the World War Bulgarian forces invaded the town, but the peace treaties restored it to Yugoslavia. In the center of a region producing mulberries and maize, Veles's commerce in pottery and silk fabrics is active. The population, once largely Moslem, is now chiefly Bulgarian. Pop. 1931, 13,440.

VELEZ DE GUEVARA, LUIS (1579-1644), Spanish writer, was born at Ecija in 1579. Although more famous as a novelist, he wrote at least 400 pieces for the stage, of which 80 survive. He was a soldier in Italy and Africa, and served as chamberlain to Philip IV. In 1641 he published *El diablo cojuelo*, on which Le Sage founded his well-known *diabole boiteux*. Guevara died at Madrid, Nov. 10, 1644.

VELIKA KIKINDA, also known as Kikinda, a city of the former Vojvodina, YUGOSLAVIA, situated in the center of the Banat district, famous for its wheat, which forms the chief trade of the town. Until 1918 part of Hungary, upon the disruption of the Austro-Hungarian Empire the town was included in the new kingdom of Yugoslavia. Pop. 1931, 28,011.

VELOCITY. The motion of a body is either one of translation or rotation, or both. If the body moves about a point outside of itself, it is a movement of translation. If the body moves about a point within itself, it is spoken of as rotation. The earth moves around the sun. This is translation, but at the same time the earth rotates upon its axis. The earth has, therefore, so far as the sun is concerned, the combined motions of translation and rotation.

Where a body moves about some point outside of itself, that movement is a revolution. The earth revolves about the sun but rotates on its axis. The misuse of these two words is a very common practice. When a body moves, it does so at a certain rate. If a body is revolving, it has a linear rate of translation and a *linear speed*. In a rotating body, there exists an *angular speed* or rate of rotation.

Speed is the rate of change of position, either of translation or of rotation. If we are concerned with the direction in which the rate of change of position occurs, then the word *velocity* is used instead. Speed is merely a *scalar quantity* while velocity is a *vector quantity*. Thus, if a body is moving due east, it has a velocity involving both magnitude and direction, while if a body is merely changing its position, the direction is not involved and the body possesses speed only.

A body moving, e.g., due northeast at a velocity of 30 mi. per hr. or 1,000 m. per min., may do so at a uniform or a variable rate. In the first case, it is called a *uniform velocity* and in the second case an *accelerated velocity*. When a body starts from rest it is accelerated; when it is stopped it has a negative acceleration, or *deceleration*.

Acceleration is the rate at which a velocity changes its magnitude. Inasmuch as a velocity is a rate of change of position, acceleration is a rate of a rate. This may be expressed as a formula in the following way:

$$\text{linear velocity} = \frac{\text{distance}}{\text{time}} \text{ or } v = \frac{d}{t}$$

and,

$$\text{linear acceleration} = \frac{\text{linear velocity}}{\text{time}} \text{ or } a = \frac{v}{t}$$

A similar relation holds for angular velocity which may be expressed in DEGREES or radians per second:

$$\text{angular velocity} = \frac{\text{angle}}{\text{time}} \text{ or } \omega = \frac{\theta}{t}$$

$$\text{angular acceleration} = \frac{\text{angular velocity}}{\text{time}} \text{ or } \alpha = \frac{\omega}{t}$$

S. R. W.

VELOCITY OF ESCAPE, the speed necessary to enable an object to escape from the gravitational attraction of another body.

VELOCITY OF LIGHT. This important constant in nature has a value of approximately 3×10^{10} cm., or 186,000 miles per sec., in a vacuum. Its first determination was an astronomical one by Roemer in 1675, based on the eclipses of the moons of Jupiter and the time required for the signal of the eclipse to travel across the earth's orbit. In 1849, Fizeau, and, in 1862, Foucault, devised new methods, the latter's method being over short enough distances to become a laboratory procedure. It consists of allowing light from *S* (see figure) to pass through a lens, *L*, and to be reflected by the mirror, *R*, to a focus on a mirror, *M*. The light retraces its path to *R*, and, on reflection from a half-silvered mirror, *N*, comes to a focus at *P*. If the mirror, *R*, is rotated rapidly in the direction of the arrow, it will move through a small angle, α , while

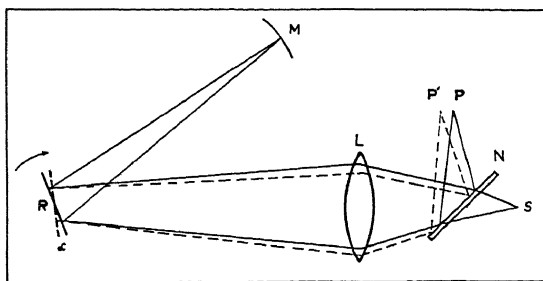


DIAGRAM OF FOUCAULT'S SET-UP FOR VELOCITY OF LIGHT MEASUREMENT

the light travels to *M* and back, so that the image of *S* shifts from *P* to *P'*. Knowledge of the distances, *R* to *M* and *P* to *P'*, and of the rate of rotation permits a calculation of the velocity of light. By placing a tube of water between *R* and *M*, Foucault found the velocity in water to be less than in air, thus giving a final blow to Newton's corpuscular theory of light.

The most accurate determinations have been made by Michelson, using Foucault's method with refinements. His latest available value is $(2.99796 \pm$

.00004) $\times 10^{10}$ cm. per sec. The velocity of light in all transparent substances is less than in a vacuum by a factor called the index of REFRACTION. In some substances, such as metals, the index of refraction appears to be less than unity, indicating a velocity greater than in a vacuum.

If light is propagated in ether, then it should be possible to measure the earth's velocity with respect to ether by noting corresponding changes in the apparent velocity of light. The most famous experiments on this were made by Michelson and Morley in 1887, the results being entirely negative (see MICHELSON AND MORLEY EXPERIMENT). This led EINSTEIN to assume that the apparent velocity of light is a constant without regard to any motion of the observers through the ether. This statement is the basis of the RELATIVITY theory. See also PROPAGATION OF LIGHT. P. I. W.

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VELOCITY OF SOUND. Newton showed in 1687, that the rate at which a disturbance travels in a medium is numerically equal to the square root of the ratio of the elasticity of a medium to its density.

The following are approximate values of the velocity of sound in different materials:

Material	Velocity	
	m. per sec.	ft. per sec.
Iron	5,000	16,410
Brass	3,500	11,480
Lead	1,227	4,026
Tin	2,500	8,200
Vulcanized rubber	69	226
Air (Temp. 0°C. or 32°F.)	332	1,089
Carbon dioxide	258	846
Hydrogen	1,269	4,165
Water	1,450	4,750

Since the density of air varies with the temperature there is a corresponding variation in the velocity of sound. An approximate rule for finding the velocity in air at moderate temperature is to add 11 ft. per sec. for every 10° F. rise in temperature above 32°. See also SOUND. P. E. S.

VELSEN, a village in the Dutch province of North Holland on the North Sea Canal, important for its nitrogen, paper factories and smelting works. Located in the village is the famous castle Brederode. It is united with Ymuiden, forming a parish. Pop. 1930, 41,417.

VELVET GRASS (*Notholcus lanatus*), a handsome perennial called also white timothy and soft grass. The plant is a native of Europe and Asia extensively naturalized in the United States. It is an erect, velvety-hairy grass, 2 to 3 ft. high, bearing a narrow purplish flowering panicle. It is most useful when sown in moist sandy soils where other meadow grasses do not thrive.

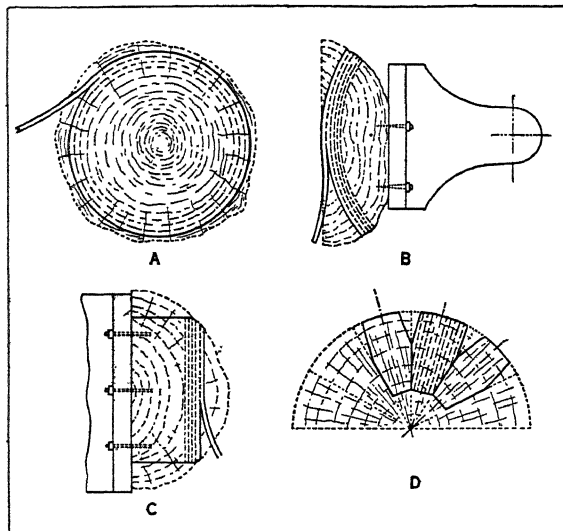
VELVET LEAF (*Abutilon Theophrasti*), a stout annual of the mallow family, called also Indian hemp. It is a native of India widespread in mild climates as a weed. The plant grows 3 to 6 ft. high with velvety-hairy stems and foliage, solitary, bright yellow flowers on stout, axillary stalks and a

somewhat burlike fruit composed of numerous sharp-beaked pods. See also ABUTILON.

VENANGO TRAIL, a famous Indian thoroughfare from the Forks of the Ohio to Lake Erie. It was the main landward route to Lake Erie followed by the Pennsylvania fur traders, and connected the chain of French posts built shortly before the FRENCH AND INDIAN WAR. From Ft. Duquesne, at the Forks, it followed the watershed between the Beaver and the Allegheny rivers to Ft. Venango (now Franklin, Pa.), ascended French Creek and thence by portage reached Presque Isle (now Erie).

VENDÉE, WARS OF THE, insurrections which broke out in Vendée, a department of France, as an anti-revolutionary reaction in Mar. 1793. The Vendée was wholly peasant country and objected to the republican and particularly to the anti-clerical policy of the Convention. The attempt to introduce conscription touched off an unorganized peasant rebellion. Royalist leaders, such as La Rochejaquelein and Charette de la Contrie, joined the movements. Some arms and a measure of financing by forged assignats were obtained from England and the war was pushed north of the Loire. In April the revolt spread into Brittany, Normandy and Maine, and the regular armies of the republic had to be called in. The organized military power of the Vendéans was crushed by Dec. 1793 and terms concluded in Feb. 1795 granted toleration of the Church in Vendée and exemption from conscription. Irregular disorders continued, however, and the country was only completely pacified in 1800 after a loss of some 150,000 men.

See *Cambridge Modern History*, Vol. 8, p. 382.



CUTTING VENEER FROM LOGS

A, Peeling veneer from the log on a lathe. B, cutting "half-round." C, slicing sheets from a hewn log. D, cutting quarter-sawn veneer by first dividing the log into "flitches."

VENEER, sheets of thin material, usually wood, peeled, sliced or sawed from logs, either to be used in single layers or built up into PLYWOOD or other laminated products. The more beautiful and valuable

woods are usually sliced in sheets from 1/20 to 1/30 in. thick. The commoner woods, used for strength rather than decorative purposes, are peeled from logs on the lathe, resulting in greater utilization of the log. Some woods, like oak, that split and tear easily in the knife cutting process are sawed on segment saws. Veneer has been made as thin as 1/100 in., and seldom can be successfully cut thicker than 1/4 in. Veneer is principally used for plywood, but is also utilized to a large extent in plywood box shooks and for packages and fruit containers. The face of veneered panels is frequently inlaid with decorative woods or overlaid with attractive superfigure.

Veneer (except some varieties) utilizes the log rather completely, since the wasteful saw kerf is eliminated. The only losses are in rounding the log and in discarding the small core. T. D. P.

VENER, LAKE. See **WENER**.

VENERABLE. 1, The title applied to pious people whose BEATIFICATION has been sought, their martyrdom or virtue proved, and a document to that effect issued and signed by the pope. This, however, does not authorize public veneration. 2, A title applied to archdeacons of the Anglican Church and also to Roman Catholic archdeacons in Ireland and Australia. It is also applied to a Carthusian monk and to a preacher-general.

VENEREAL DISEASES, a general term for a group of diseases, the specific names for which are syphilis, gonorrhea, and chancroid. These are dangerous communicable diseases, each being quite different from the others. Because the infecting organisms do not ordinarily survive drying more than a few hours, their transmission in a virulent state from one person to another usually depends upon intimate contact of moist surfaces. However, any article with infectious discharges on it, which have been protected from drying or other bactericidal influence, may enable the organisms to escape from the infected person and enter the body of a susceptible person. Because these diseases rarely spread in any way except through the tissues of the reproductive system, they have been commonly called venereal diseases.

Prevalence. This group of infections are found throughout the civilized world. At the present time in the United States it is estimated that there are 643,000 cases of syphilis and 474,000 cases of gonorrhea constantly under medical care. It is considered probable that more than a million new cases yearly take their places in the lists of persons under treatment. The prevalence rate of venereal diseases derived from figures based upon case records of licensed practitioners and treatment agencies throughout the nation has been computed at 7.5 per thousand of the whole population. In a series of studies of large population groups aggregating some twenty-five million persons, prevalence rates were found ranging from 3 to 12 per thousand. These figures do not include the untreated and unreported cases. There is reason to believe, from surveys of urban population,

that a very considerable proportion are "self-treated" with home remedies or "patent medicines," by druggists, or by unlicensed practitioners, and are not reported. Investigations have shown that charlatans exploit very large numbers of the victims of these diseases. The intensive use of the Wassermann and other reactions for syphilis in studies of large groups of persons has indicated that no less than 10% of the population of large cities have been infected with syphilis. This is probably an underestimate of conditions in some areas. However, as the prevalence of infection in rural areas is somewhat lower, this figure may reasonably be taken as an estimate for the country at large. While the figures for gonorrhea are less complete, there is a general opinion among medical authorities that the true incidence would show the disease to be much more prevalent than syphilis. For example, among enlisted men in the United States Navy in 1929, there were 3.5 cases of gonorrhea for each case of syphilis. Chancroid is not considered an important public health problem in comparison with the other two in this group and it is much less prevalent.

Syphilis. Syphilis is caused by the *Spirochaeta pallida*, which, though very easily killed outside the body, is highly virulent when introduced through any minute opening of the skin or mucous membrane. In from four to six weeks the primary sore, or chancre, appears at the site of inoculation. If this is in a hidden part, the sore, which is painless, may be entirely overlooked. At this stage the spirochetes may be found in exudates from the chancre. The infection remains local for a short time, then spreads throughout the body. General discomfort, swelling of glands, eruptions on the skin and in the mucous membranes of the mouth are manifestations of the secondary stage.

At this time the Wassermann reaction in the blood becomes positive. In explanation it may be said that, with the spread of syphilis through the body, the reaction of blood serum becomes "positive" to specific tests, which depend upon changes in the biochemical properties of serum governed by the presence of syphilitic infection. Though not infallible, the tests based on this fact constitute a great aid in the diagnosis of syphilis. The Wassermann test was the first of these to be used, and is the one most widely known. Since its discovery the technique has been modified and improved, but still elaborate equipment and a high degree of technical skill are necessary for its reliable performance. Much effort has been devoted to the development of more simple, accurate, and inexpensive serological tests, and some have been devised such as the Kahn test which is being widely utilized, especially in conjunction with the Wassermann test. Where both the above tests are used, the percentage of error in diagnosis is reduced to a minimum.

At the same time, also, the disease begins its attack upon various organs, so that even if outward signs of the so-called secondary stage are slight or

absent, untreated cases will later appear in what are popularly known as third stage manifestations. These are recognized medically as LOCOMOTOR ATAXIA, GENERAL PARESIS, BLINDNESS, HEART DISEASE, or other diseases of vital organs. Abscesses, or gummata, which are sometimes very destructive of tissues, may appear among these late manifestations of the disease.

Congenital syphilis is the result of infection of the child within the womb by the *Spirochaeta pallida*. It is an important cause of abortions and still-births. Syphilitic infants, even after birth, frequently die within a few weeks. If they survive, they may develop any of the later manifestations of the disease. Congenital syphilis can be prevented by adequate treatment of the mother during pregnancy. Acquired syphilis, properly treated in the very early stages, offers a good prospect of cure. Even in the later manifestations, the ravages of the disease may be checked and the patient's general condition greatly improved by adequate treatment. Thus, while there is always hope for the patient, the great fact to be taught is that early diagnosis and prompt continued treatment are of vital importance. (See ARSPHENAMINE.)

Gonorrhea. Gonorrhea is principally a specific inflammation of the mucous membranes of the genitourinary organs. The attack usually begins from three to fourteen days after infection as a local acute condition with pain and discharge of pus. With good body resistance and prompt treatment, the extent of the inflammation may be limited, the invading organism killed, and the tissues restored to normal. Infections not successfully combated may spread to the prostate, bladder, or testes in the male, or through the uterus to the tubes and ovaries in the female. In both, but especially in women, the result may be STERILITY and chronic invalidism; or the joints and other parts of the body may be attacked. The eye, especially in infants at birth, may be infected (see CHILDREN, DISEASES OF; EYE, AFFECTIONS OF). A significant number of such infections result in blindness (see BLINDNESS, MEDICAL ASPECTS OF). That this number is constantly decreasing, despite the wide prevalence of gonorrhea in adults, is indicated by case records of children admitted to schools for the blind. Over a period of 23 years ophthalmia neonatorum (a proportion of which is caused by gonorrhea) as a cause of blindness decreased 67 per cent. This decrease is probably due in large part to increased efficiency in the disinfection of babies' eyes at birth. The communicability of the infection may persist after all acute signs have subsided. Cure can be determined only by the most thorough clinical and laboratory search to prove the absence of gonococci. (See also GONORRHEA.)

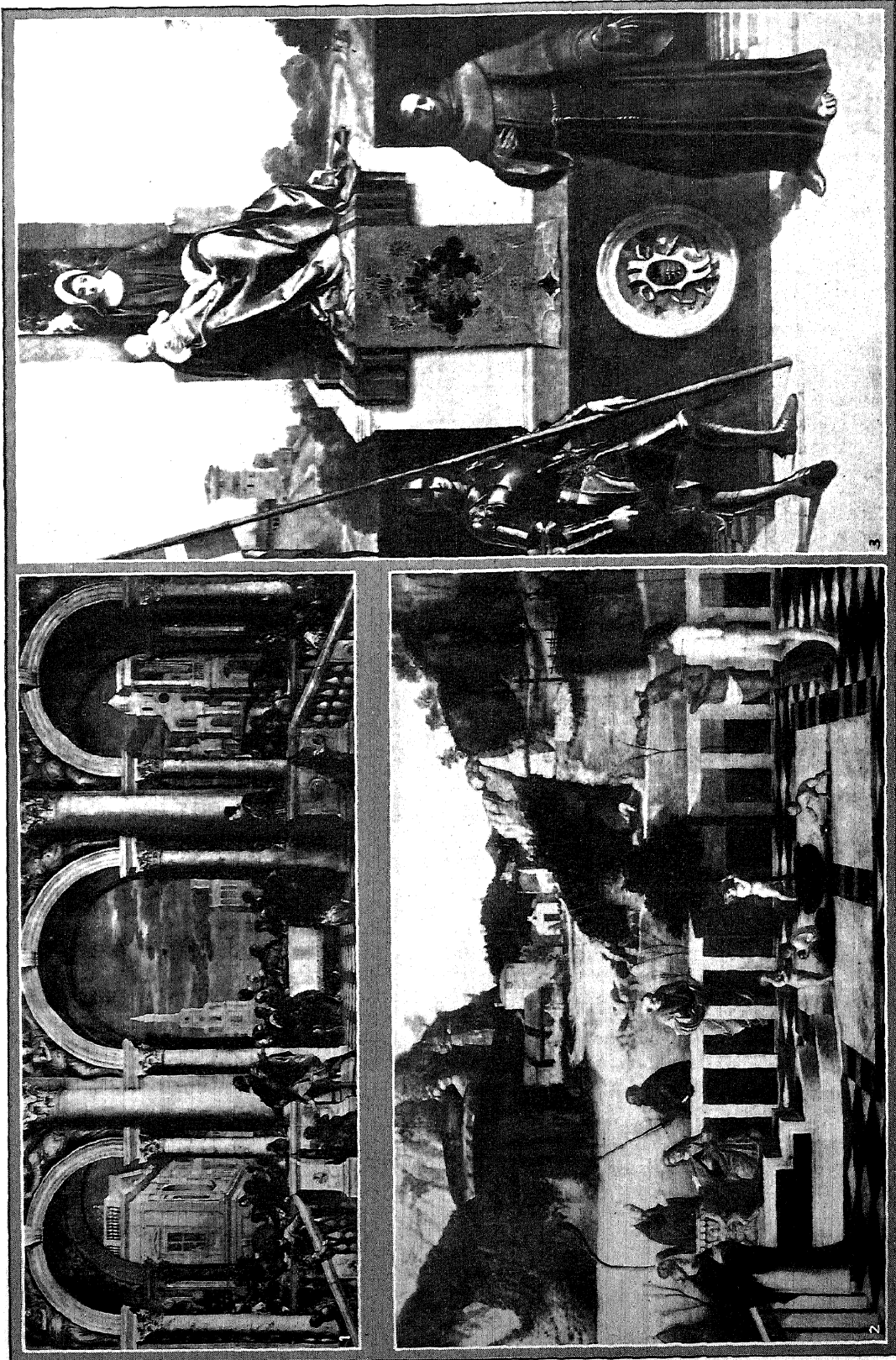
Chancroid. Chancroid, or soft chancre, is an ulcer of the genitals caused by the bacillus of Ducrey, and is a communicable disease. Except that it may cause swelling of the glands of the groin, the disease is purely local. It yields readily to prompt and proper treatment; but it may mask a concomitant infection with either or both of the other so-called venereal diseases. (See also CHANCROID.)

For public health reasons, as well as for the protection and care of individuals, the prevention and control of this group of diseases is most important. Measures for this purpose include: (1) The extension of laboratory and medical consultation services for detection of indications of infection, and the encouragement of every practical effort to bring infected members of the community under advice and treatment. (2) Clinical confirmation of cases selected for treatment, and adequate treatment followed by medical supervision until the patient and community have received the maximum benefit and protection afforded by modern knowledge. (3) Adequate social service follow-up, instituted as a routine procedure, to ensure success by helping each patient to apply the instructions given; such work is done with the understanding that medical information concerning the presence of syphilis or gonorrhea in an individual is confidential and not to be used for any purpose except the treatment of the patient and protection of others from the infection. (4) Public information activities, directed through every available channel, toward the development and support of the necessary measures.

The public is slowly coming to the acceptance of the view that the venereal diseases should be considered as infectious, preventable, and controllable; and should be considered and treated with the same thorough and sympathetic attention to patients which characterizes the public attitude and provisions for tuberculosis and other great groups of infectious diseases. The results of laws and measures devised for this purpose cannot yet be measured; but there are indications of what may be expected in the future. For example, the death-rate from syphilis, locomotor ataxia, and general paralysis of the insane combined, has declined 30% between 1917 and 1929 (i.e., from 19.8 to 13.0 per 100,000 population), despite constantly increasing facilities, and efforts to discover syphilis in all its manifestations. Figures from life insurance companies indicate a similar downward trend in the death-rate from syphilis. The death-rate estimates for infants under one year of age have decreased about one third during the same period; and thus suggests that some part of this decline may be due to the fact that this is the period during which the prenatal syphilis treatment of mothers has been perfected and promoted. Both Army and Navy incidence rates show a large and progressive net decrease of the venereal diseases over a period of the last twenty years. W. F. S.

VENETIAN SCHOOL OF PAINTING, last born of the Italian schools and the rival of the FLORENTINE SCHOOL in producing some of the most beautiful painting in the world. The development and supremacy of Venetian art fell within the period from about 1475 to the time of Titian's death in 1577. Once it came to birth it reached maturity much more rapidly than did the Florentine School largely because of the temperament and circumstances of the life it so faithfully mirrored. The Venetians loved magnificence, took delight in the senses and had a passion for

VENETIAN SCHOOL OF PAINTING



PAINTINGS OF THE VENETIAN SCHOOL

1. "The Feast in the House of Levi," by Paolo Veronese, in the Venetian Academy.
2. "Allegory of the Tree of Life," by Giovanni Bellini, in the Uffizi Gallery, Florence.
3. Altarpiece, "Madonna and Child with St. Francis and St. Libérale," by Giorgione, in the Castelfranco Veneto Cathedral.

enjoyment in the present life. Their materialized ideals of beauty were best expressed by color which, together with sumptuous decoration, may be said to characterize the Venetian School. A close oligarchy of princely merchants, in touch with Oriental luxuriance and denying the overlordship of the Pope, demanded a gorgeous pageantry. A type of state religion of pagan pomp grew up, emphasizing worship of the patron saints, and assuming the form of glittering, impressive ceremonials. In painting, religious subjects prevailed, but sentiment and dramatic action took the place of mystical devotion. The full magic of glowing color was used to delight the senses and give a feeling of gaiety and resplendent grandeur.

The Venetian School was founded by the Bellini family, and was built on the 14th century academic traditions of the Vivarini, but so enriched that all the leading tendencies of the early Renaissance originated with them. While oils had been used by his contemporaries, the Van Eycks and Messina, GIOVANNI BELLINI, the really great member of the family, first used them with freedom and perfected a technique for a structural use of color and a blending of it with light to create what came to be termed the Venetian glow. His studio was literally the Venetian School, for here congregated the brilliant young artists of the period. Among the most famous were CARPACCIO, the renowned teller of tales; GIORGIONE, whose altarpiece at Castelfranco is given rank by Ruskin as "one of the two most perfect pictures in existence"; Palma Vecchio, painter of surface beauty; Catena; Lotto; and Titian, the glory of Venetian painting. TINTORETTO introduced dramatic movement through the technical device of a swirl of light, color and line fused into one. Paolo Veronese, last of the great painters, used his supreme craftsmanship to portray the glamour of the dazzling materialism of Venice before the decline of her supremacy.

VENETIC, an extinct INDO-EUROPEAN language of northeastern Italy, preserved in nearly 200 short inscriptions in an alphabet probably derived from ETRUSCAN and dating from at least the 4th century B.C. It apparently belongs to the *centum*-group (see CENTUM-LANGUAGES), but its precise affinities, except with LEPONTINE, are uncertain. In some respects it is akin to ILLYRIAN, in others to ITALIC and CELTIC; on the whole, it seems to belong to none of these, but rather to the LIGURIAN stock.

VENEZUELA, the northernmost state of South America, bounded on the north by the Caribbean Sea, on the south by Brazil and Colombia, on the east by British Guiana and on the west by Colombia, stretching from 12° 26' N. lat. to within two degrees of the Equator. Area 394,000 sq. mi.

Surface Features. The country has four distinct sections: a mountain region including the Venezuelan Andes, which is a branch of the east Cordillera of Colombia, and the Maritime Andes extending along the coast; the great plain of the *llanos* occupying a large part of the Orinoco basin, lying east and south of the mountains; the Guiana or Guayana highlands

south of the Orinoco, extending to the eastern and southern boundaries and occupying a great extent of unexplored country, and the coastal plain around Lake Maracaibo. The region has 72 large and more or less navigable rivers, of which the ORINOCO is the chief. Among the 205 lakes, MARACAIBO is the largest and most important. Other lakes are Valencia, Zulia, Laguneta and Camaguan, but many are only shallow lagoons which serve as breeding places for mosquitoes.

North of eastern Venezuela is a group of islands of which Margarita is the largest. The 40,000 people of the islands are supported mainly by the fishing industries. At one time pearl fishing in these waters was an important industry, but a disease attacked the oysters and the industry dwindled though it still continues. On Margarita are extensive deposits of magnesite, but the output is small.

Population. *Mestizo*, Indian and Negro elements form a numerous, very low class far removed from a powerful and rather progressive upper group. West Indian Negroes and other colored races are now forbidden entrance to Venezuela by law. Owing to the high wages, the oil fields have caused a dangerous surplus of city population so that until a recent reaction occurred, the agricultural districts have suffered for want of hands.

Climate. The climate is hot but not unhealthy, except in the wilder regions. It is tropical to about 2,000 ft. above sea level; above that to 7,000 ft. it is temperate; still higher, cold with mean annual temperatures ranging from 60° to zero or less in the high Andes. The coast has two rainy seasons, December and January, and April to July. On the great plains the dry season is from November to May or June, the following rainy to November.

Forest Industries. The forest resources are almost inexhaustible but hardly touched. In most respects they resemble those of the Amazonian forest. The principal forest product is balata. Rubber has declined greatly as a product. The tonka bean, the extract of which is an important perfume base, is exported in large quantities. The tree *Dipteryx odorata* grows especially well in the north. The *caoba* or mahogany tree grows from sea level to about 3,000 ft. It may be seen along the streets of Valencia and attains a height of 130 ft. with a diameter of 4 ft. at the base. A few small shipments of cedar logs for Trinidad leave the region. Numerous valuable woods abound but are little exploited mainly because of lack of transportation facilities.

Agriculture. Conditions of farming, generally, are most primitive, although many tractors and modern farm appliances are now being used on the large plantations. Cultivated clearings produce chiefly yucca, cassava, sugar-cane, plantains, corn and bananas. An extensive plain area averaging some 1,500 ft. in elevation, the Lake Valencia basin, is a region of great agricultural value. It is the most thickly settled part of Venezuela. Besides cultivating cotton, coffee and cacao, the district is Venezuela's granary

for corn and beans. In addition sugar, tobacco, rice and many truck crops and fruits are cultivated.

Minerals. There is one gold mining region of importance. It is the famous El Callao district near the boundary of Colombia. Copper has been mined in small quantities since the early Spanish days. Asphalt occurs in various places, coal is mined in small quantities and iron ore of good quality exists in several localities. So rapid has been the development of petroleum that exports in 1926 were less by only 850,000 bbls. than the total shipments for all previous years, and in 1929, with a production of 137,474,000 bbls. Venezuela was the second oil producing country of the world. Practically all of Venezuelan oil originates in the Maracaibo region, both in and about the margins of the lake.

Chief Cities. CARACAS, the capital, has a university. MARACAIBO is the port near Lake Maracaibo, and La Guaira is the chief seaport. VALENCIA, a beautiful city, is also an important town. Coro contains the first cathedral built in the New World.

HISTORY

On his third voyage to America, in 1498, CHRISTOPHER COLUMBUS entered the Gulf of Paria, sighting the continental mainland for the first time. Alonzo de Ojeda, accompanied by AMERIGO VESPUCCI, in 1499 followed the coast to Lake Maracaibo, and named the region "Little Venice." Cumaná, the first settlement, was founded in 1523; Coro was established four years later. Charles V in 1528 granted to the Welsers, a banking firm of Augsburg and his creditors, that part of Venezuela lying between Cape Vela and Maracapaná; their agents enslaved the natives and so demoralized the country that in 1546 the grant was revoked. The territory was then put under Spanish administration, with Coro as its capital until 1576, and thereafter the town of Caracas. Exploitation of the pearl fisheries, and the raising of cacao and tobacco, were the leading Spanish colonial activities in Venezuela. In 1728, a monopoly of trade with Venezuela was granted to a Biscayan merchant company, Compañia Guipozcoana, which maintained nominal control until 1778.

The first definite attempt in South America to gain independence from Spain was made by Venezuela, where, in 1810, the cabildo of Caracas deposed the royal governor. SIMON BOLIVAR led the popular demonstration culminating in a formal declaration of independence, July 5, 1811, and the proclamation, in December, of Republican Constitutional Government. Temporary royalist successes were bolstered by the arrival of 10,000 troops from Spain in 1815; Bolivar withdrew to Haiti, but returned in 1817 and established a Government at Angostura. In 1819 the Congress at Angostura elected him President of Colombia embracing Venezuela and New Granada. The decisive Battle of Carabobo, June 24, 1821, assured the success of the Republican principle. Venezuela seceded from Colombia in Apr. 1830, establishing an independent republic with its capital at Caracas.

José Antonio Paez, its first president, adopted a tolerant attitude toward the Roman Catholic Church and fostered measures for the stimulation of trade. The political history of Venezuela was comparatively uneventful until the year 1848 ushered in an era of civil wars between Conservative and Liberal factions which lasted until, in 1870, Antonio Guzman Blanco began the pacification of the country. Under his benevolent despotism, maintained directly or indirectly until 1888, the public debt was stabilized, the building of railroads begun and other means of communication improved; the University of Caracas was reformed and technological education emphasized; and the capital city beautified. Blanco, a Mason, stripped the Catholic Church in Venezuela of much of its wealth and authority; but his project to establish a purely national church failed of support in Congress.

Blanco's retirement was followed by protracted struggles between rival aspirants to the presidency until Gen. Joaquin Crespo, 1892-98, imposed upon the country another interval of peace and order. A boundary dispute of long standing, over the demarcation between Venezuela and British Guiana, suddenly reached a crisis, but was settled by international arbitration. (See VENEZUELA BOUNDARY DISPUTE). The destruction of the property of foreigners during the dictatorship of the unscrupulous CIPRIANO CASTRO, 1899-1908, brought about a critical situation in 1902, when warships of Germany, Great Britain, and Italy blockaded the chief ports of Venezuela; ultimately all foreign claims against Venezuela were referred to a series of mixed commissions. Castro's successor, 1909, Juan Vicente Gomez, as president and as generalissimo of the army has maintained a personal rule for a longer period and probably with greater authority than any of his predecessors.

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VENEZUELA BOUNDARY DISPUTE, an international controversy, involving the United States, over conflicting territorial claims of Venezuela and British Guiana. The probability of British military occupation of the region in dispute, including approximately 33,000 sq. mi. west of the Essequibo River, induced President Cleveland in July, 1895, through Secretary of State Richard F. Olney, to demand that Great Britain submit the dispute to arbitration. He declared further that an extension of the boundary of British Guiana would be a violation of the MONROE DOCTRINE. After President Cleveland had vigorously reaffirmed his attitude in a special message to Congress, Dec. 17, 1895, and had appointed a commission to obtain information necessary for a judicial settlement of the boundary, the British Government retracted its previous rejection of arbitration. The final decision of the arbiters gave the larger share of the disputed area to Great Britain, but assigned the mouth of the Orinoco River to Venezuela.

VENEZUELAN LITERATURE, the literature of the Republic of Venezuela, South America, a treat-

VENEZUELA

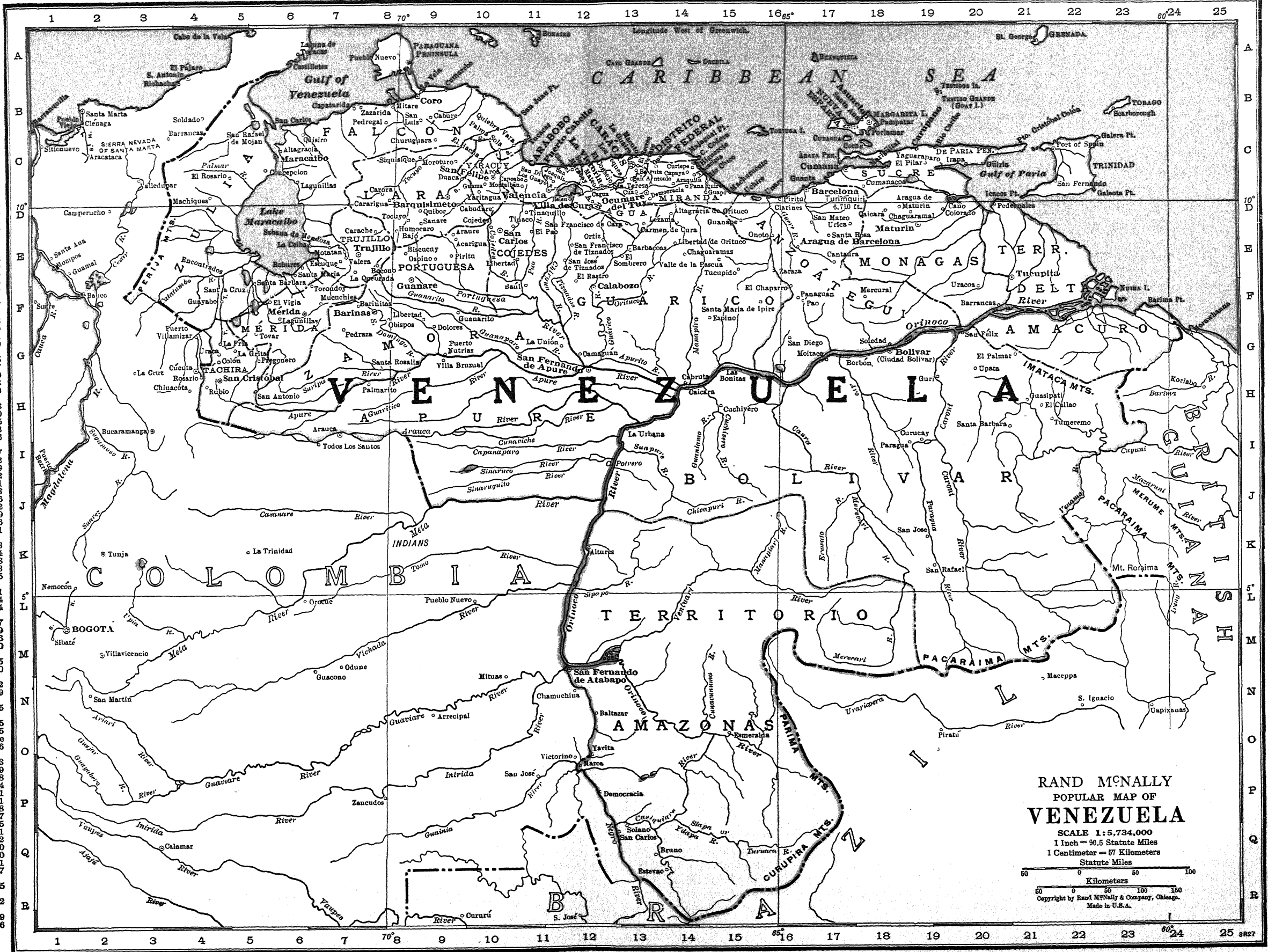
Area 393,874 sq. m.
Pop. 3,250,000

PRINCIPAL CITIES

(Including Figures from Latest Population Estimates)

Pop.—Thousands

- 12 Alta Gracia de Orituco. D 14
- 9 Aragua de Barcelona. E 16
- 9 Araure. E 9
- 13 Aroa. C 10
- 8 Barcelona. D 17
- 7 Barinitas. F 7
- 23 Barquisimeto. D 9
- 6 Belén. D 12
- 6 Biscucuy. E 8
- 33 Bocono. E 8
- 17 Bolívar (Ciudad Bolívar). G 13
- 6 Cabudare. D 10
- 6 Cantaura. E 17
- 135 Caracas. C 13
- 12 Carache. D 8
- 12 Carúpano. C 19
- 8 Churuguara. C 9
- 6 Concepción. C 5
- 12 Coro. B 9
- 12 Cua. D 13
- 19 Cumana. C 17
- 6 Cumanacoa. D 18
- 7 Cumarebo. B 9
- 13 El Pao. E 11
- 12 El Pilar. C 19
- 9 Encontrados. E 5
- 7 Escucue. E 7
- 6 Guama. D 10
- 5 Guaremas. C 13
- 6 Guiría. C 20
- 7 Humocaro. D 8
- 8 Irapa. C 20
- 16 La Grita. G 5
- 8 La Guaira. C 13
- 6 Lagunillas. F 6
- 6 La Quebrada. E 7
- 5 La Unión. G 12
- 5 La Vela. B 9
- 17 La Victoria. D 12
- 5 Libertad. E 11
- 10 Los Teques. C 13
- 100 Maracaibo. C 6
- 13 Maracay. D 12
- 5 Maturín. D 19
- 9 Mérida. F 15
- 9 Montalbán. D 11
- 6 Ocumare del Tuy. D 13
- 5 Panaquire. D 14
- 6 Pedregal. B 8
- 10 Petare. C 13
- 13 Pregonero. G 5
- 14 Puerto Cabello. C 11
- 7 Río Chico. D 14
- 16 Rubio. H 4
- 5 Sabana de Mendoza. E 7
- 12 Sanare. D 9
- 7 San Carlos. B 6
- 7 San Rafael de Mojan. B 5
- 10 Santa Barbara. F 5
- 5 Santa Cruz. F 5
- 5 Santa María de Ipire. F 16
- 9 Santa Teresa. D 13
- 15 Siquisique. C 9
- 5 Soledad. G 18
- 6 Tacarigua. C 14
- 10 Tinaco. D 11
- 17 Tinaquillo. D 11
- 15 Tucuy. D 8
- 18 Trujillo. E 7
- 11 Tucupido. E 15
- 3 Tucupita. F 21
- 8 Tumeremo. H 22
- 10 Upata. G 20
- 5 Uraoa. F 20
- 37 Valencia. D 11
- 8 Valera. E 7
- 11 Valle de la Pascua. E 15
- 14 Villa de Cura. D 12
- 9 Yaguaraparo. C 19
- 20 Zaraza. E 16



RAND McNALLY
POPULAR MAP OF
VENEZUELA

SCALE 1:5,734,000
1 Inch = 90.5 Statute Miles
1 Centimeter = 67 Kilometers

Statute Miles
Kilometers

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ment of which will be found under **LATIN-AMERICAN LITERATURE**.

VENI, VIDI, VICI ("I came, I saw, I conquered"), a sentence cited by Plutarch as the message sent back by Julius Caesar to his friend Amintius, after he had defeated Pharnaces Pontius at Zela in 47 B.C. Suetonius declares that the words antedate Caesar.

VENICE, a city in northeastern Italy, on the Adriatic, whose unique situation on a group of islands makes it one of the most extraordinary settlements in the world. The buildings are set upon piles, the principal streets are waterways. In spite of the introduction of the motor launch the historic gondola is still the characteristic vehicle of transportation. More than 175 smaller canals connect with the Grand Canal which is the city's main thoroughfare. With its highly decorative architecture and its beauty of light and color, Venice is a city of dreamlike loveliness, and is still, as it became during the Renaissance, a favorite resort of artists, travelers and pleasure-seekers.

Titian, Tintoretto, Veronese, Giorgione, Carpaccio, the Bellini, and other painters brought Venice lasting fame. Their masterpieces are best studied here, especially in the Accademia, the Gothic church of S. Maria Gloriosa dei Frari and the 16th century Scuola di San Rocco. The city is rich in Byzantine, Gothic, and Renaissance architecture. The beautiful Church of St. Mark, with its wealth of decoration, is the most celebrated building in Venice. Other famous structures are the 14th-century Doge's Palace, the many magnificent Byzantine residences, the lovely Ca' d'Oro and other Gothic palaces, the small Renaissance Church of S. Maria dei Miracoli, and the large 17th-century Church of S. Maria della Salute.

The craft of glass-making was perfected here in the Middle Ages, and has been successfully revived. Filigree jewelry, lace, wrought iron and copper are other manufactures. There is an extensive new harbor and industrial and residence areas have been planned nearby. Pop. 1931, 260,247.

HISTORY

Venice came into existence as a string of hamlets on the lagoon islands off the shores of the Roman province of Venetia during the Lombard invasion of 568. Others had sought refuge there before, and fishermen had lived in the islands; but it was the Lombard rather than the usually accepted Hunnish invasion which resulted in a definite establishment. The settlement soon turned to the Byzantine Empire for protection, and received a charter organizing 12 villages in 584. The first doge was elected in 697, and as a result of an attack by the fleet of the Frankish King Pepin the villages agreed upon a joint capital at Rialto, the modern city, in the midst of the lagoons.

Rise of Naval Power. During the 9th and 10th centuries Venice was definitely a Byzantine colony, gradually growing and prospering on the Levant trade. During the 11th century the city became in-

creasingly independent and by means of its powerful fleets secured the mastery of the Adriatic. By judicious participation in the first three Crusades the city acquired trading posts throughout the Levant. And by diverting the Fourth Crusade to overthrow the Byzantine Empire Venice acquired the bulk of the Aegean and Ionian Islands.

The wealth which the Levant trade brought to Venice accentuated the oligarchic tendencies which had set in ever since the rise of Venetian naval power late in the 10th century. In 1032 the Orseoli family, who had attempted to make the office of doge practically that of hereditary sovereign, was expelled and a Senate and privy council set up as a check upon future doges. The decisive constitutional change came, however, as a result of defeat by the Byzantines in 1171. Formerly the sovereign power had resided in a general assembly of the population; but the inefficiency of such a government was felt to have led directly to the defeat, and in place of the general assembly, sovereign power was conferred upon the Great Council, originally chosen by the people but thereafter self-perpetuating. For a century the constitutional form remained unchanged, while the social life tended towards an ever greater cleavage between the extremely wealthy and the moderately well-to-do. In 1296 the latter were reduced to the political impotence to which the poor had been reduced by the institution of the Great Council, for after that year membership in the Great Council was open only to those whose ancestors had been members. This concentration of power in the hands of the great merchants was not accomplished without internal risings; but all were put down, and in 1310 with the organization of the ubiquitous Council of Ten, a committee which could exercise the most important parts of the governing functions of legislature, judiciary and executive, the oligarchic lines of the Venetian constitution were permanently laid down and lasted throughout the life of the republic.

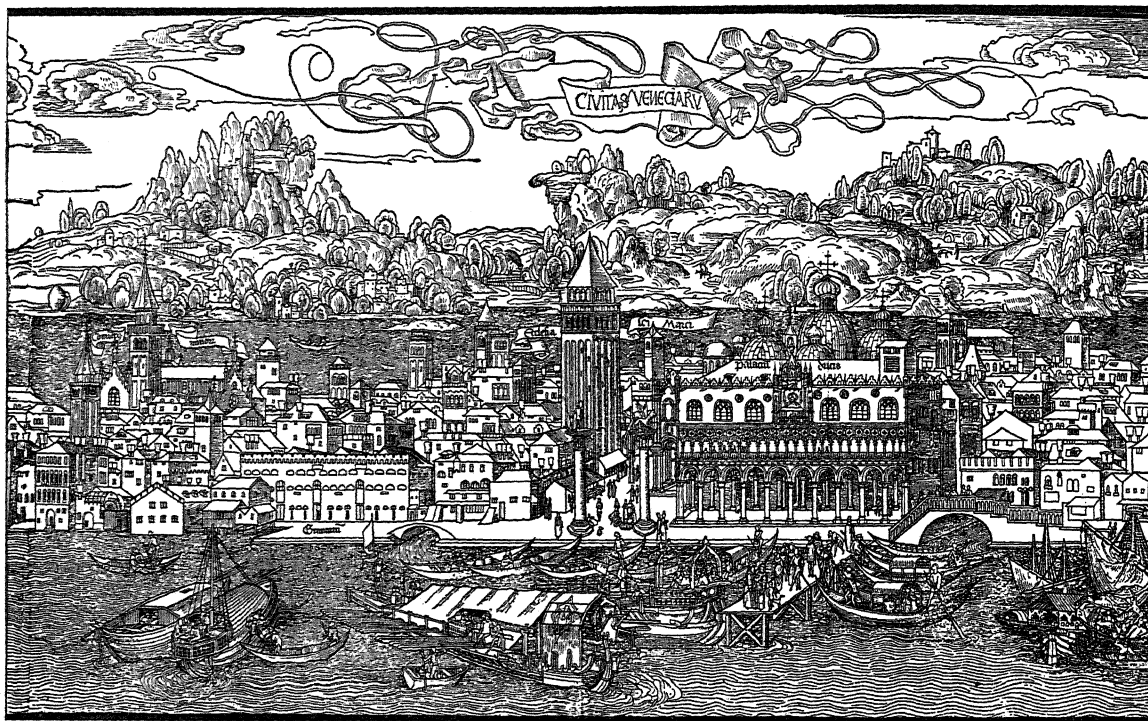
In foreign politics Venice grew into more and more bitter hostility to Genoa, her one great rival in the carrying trade. Wars occurred in 1264 and 1353 with varying fortunes but never removing either of the great antagonists. Finally in 1380 a tremendous Genoese victory was turned at the last moment into a crushing defeat at Chioggia, and Genoa ceased to exist as a maritime power in the East. Venice had in the meanwhile acquired territory on the mainland and in 1420 secured Vicenza and Verona, extending her territory from the Alps to the Po, so that during the 15th century she stood as one of the greatest powers in Europe.

Rapid Decline. The fall of Venice was complete and relatively sudden. In 1498 VASCO DA GAMA reached India by the Cape of Good Hope and within a generation the eastern trade so long a monopoly of Venice shifted to Portugal, and later to Holland and England. Venice never recovered. Long wars against the Turks, and against the European powers banded against her in the League of Cambrai, 1508, hastened

her decay. Though the republic survived, it was an increasingly powerless state, existing chiefly by sufferance of its jealous neighbors. In 1797 Napoleon handed it to Austria, and after several times being exchanged between France and Austria it became Austrian in 1814. In 1866 with the defeat of Austria in the Austro-Prussian war serving as an excuse the province was annexed to the kingdom of Italy.

During the later Middle Ages Venice was something of an anomaly in western Europe. The intimate contact with Byzantium gave to Venetian life an urban tone different from that of the more rural West. This is reflected in its art, as well as in its extreme preoccupation with commercial pursuits. Yet

VENIZELOS, ELEUTHERIOS (1864-), Premier of Greece, was born in Crete, Aug. 23, 1864. He was graduated from the University of Athens, 1886, practiced law in Crete, entered politics and held numerous public offices. He led the insurrection which drove the Turks from the island, and to the union of Crete and Greece. Called to Athens in 1910, he became Premier, revised the constitution, reorganized the army and navy, and cooperated in the formation of the Balkan League. He resigned in 1915 because of opposition to his policy of joining the Allies. When King Constantine abdicated in 1917, Venizelos took over the government. Greece then officially joined the Allies, and at the Peace Con-



COURTESY METROPOLITAN MUSEUM OF ART

VENICE IN THE 15TH CENTURY

Woodcut illustration by Erhard Reuwich for Bernardus de Breydenbach's "Peregrinations," printed at Mayence in 1486

after the wars with the League of Cambrai and the decay of Venetian power, the city became quite definitely West European, most effectively contributed to the victory of Lepanto against the Turks, and entered upon its greatest artistic life.

VENI CREATOR SPIRITUS, an ancient hymn of the Roman Breviary, composed in a classical meter and in very pure Latin, occurring in the office of the Feast of Pentecost, and at other times used as a solemn invocation of the Holy Spirit. A translation ascribed to CRANMER (1489-1556) is used in the Anglican ordination service. The hymn, which is often confused with the *Veni Sancte Spiritus* (probably by Robert II of France), has been ascribed to Pope Gregory I (d. 604), to Rabanus Maurus (d. 846), and to Charlemagne, but its true author is not known.

ference received territorial concessions in Smyrna which she later lost to Turkey. His party defeated in 1920, he lost the premiership upon the return of Constantine. In 1924 he was for a time premier when the country became a republic, but resigned for reasons of health. He resumed control in 1928, and has since remained premier except for a short period in June, 1932.

VENLO, a town in the province of Limburg, Holland, situated on the Meuse, 15 mi. northeast of Roermond. It contains several notable buildings, among them the town hall and a church dating from the early 14th century. Venlo is an important industrial and commercial center. The leading industries of the town are brewing and distilling, spinning, tanning, and needle manufacturing and tobacco preparation. Pop. 1930, 24,212.

VENTILATION, the process of supplying sufficient and proper air to an enclosed space in order to produce a desired atmospheric condition. It may be divided into uncontrolled and controlled ventilation. Uncontrolled ventilation is obtained by opening windows to allow a natural flow of air between the outside and inside of a building. The air change resulting depends upon the temperature differences between the inside and outside, the location of the windows and the velocity and direction of the wind. Controlled ventilation, sometimes called mechanical ventilation, depends upon fans for producing a positive and controllable exchange of air. With uncontrolled ventilation, "proper air" is assumed to be the available outside air; with controlled ventilation, it may be considered as the available outside air, or, as air treated so that all its physical and chemical qualities are controlled. *See also* AIR CONDITIONING; TUNNEL VENTILATION; MINE VENTILATION. F. C. H.

BIBLIOGRAPHY.—J. R. Allen and J. H. Walker, *Heating and Ventilation*, 1931.

VENTIMIGLIA, a seaport and episcopal see in the province of Imperia, Liguria, northwestern Italy, situated about $3\frac{1}{2}$ mi. east of the Franco-Italian border. The ancient Roman *Album Intimilium*, it has yielded many interesting Roman remains. The Old Town contains the cathedral, baptistery and the handsome church of San Michele. Drawings and other remains of prehistoric origin have been discovered nearby. Pop. 1931, 17,081.

VENTNOR CITY, a seaside resort city of Atlantic Co., N.J., situated on a sand island, separated from the mainland by a large tidal basin, 55 mi. southeast of Philadelphia and adjoining Atlantic City on the south. Its transportation facilities include the West Jersey and Seashore and the Atlantic City railroads, trolleys and motor bus lines. It is a popular summer resort. Pop. 1920, 2,193; 1930, 6,674.

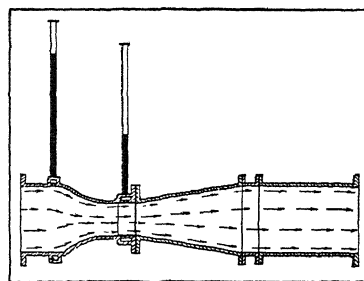
VENTRILOQUISM, a way of controlling the breath and manipulating the glottis, so that the voice appears to come from some place other than where the speaker is. Ventriloquism was known to the ancients. The hollow statues, from which a voice issued, and the famous Greek oracles may have been produced by this art. Knowledge of it is found to-day among the less cultivated tribes in Africa, Alaska and New Zealand.

Anyone having healthy vocal organs may learn ventriloquy, provided he is willing to practice and take the necessary exercises. At first it was mistakenly thought that a certain control of the stomach muscles was essential and thus the name originated. The tongue and palate are really the two organs necessary in producing sound. Success depends on the evaluation of sounds at certain given distances and the power to imitate or reproduce these sounds with all their varying tone values. The breath must be controlled and allowed to escape slowly. This is called fixing the voice. Different sounds are produced by opening and closing the throat, pressing on the vocal cords, and by the flexibility of the tongue. Words

should be enunciated as clearly as possible. The clever ventriloquist will try to focus his audience's attention on the spots where the sounds are supposed to be coming from. The letters b, m, p, v and w are hard to say. Pronouncing the sound nearest the letter such as emg, or wve, is a way of overcoming the difficulty.

VENTURA, officially San Buenaventura, a port city on the southwestern coast of California, the county seat of Ventura Co. Situated on the Pacific Ocean 60 mi. northwest of Los Angeles, it is served by the Southern Pacific Railroad, by bus lines and by freight steamers. The city is a shipping center for the surrounding farming, orchard and nut-growing region also for the oil fields of the vicinity. The chief local industries are oil refining and the manufacture of farm implements. The retail trade in 1929 amounted to \$13,132,313. The Spanish established a mission here in 1782; the city was incorporated in 1866. Pop. 1920, 4,156; 1930, 11,603.

VENTURI METERS consist essentially of two parts, the "tube," and the registering instrument. No mechanism or obstruction is in the path of the flowing water. Its reading depends solely upon the relative



VENTURI METER

pressures in two small pipes leading from the upstream end, and from the "throat" of the tube. Its principle is based upon the relation between velocity and pressure in water flowing through a continuous pipe of varying cross-sectional area. *See* HYDRODYNAMICS. It is used for measuring water, steam, gas oil and other fluids and for controlling the rate of filtration of mechanical filters.

BIBLIOGRAPHY.—G. B. Warren, *Simplification of Venturi Meter Calculations*, 1920.

VENUS, the Roman goddess of love and beauty corresponding to the Greek APHRODITE. She was beloved of MARS, the god of war, and was attended by CUPID.

VENUS, the second planet in order of distance from the sun, revolving around it in 225 days at distance of 67 million miles, in an orbit which is very nearly circular. Its distance from the earth varies from 26 million to 160 million miles. As the orbit of Venus lies entirely inside that of the earth, the planet can never be seen more than 48° distant from the sun and shows phases, like the moon. About the time of greatest ELONGATION Venus is more than 10 times as brilliant as the brightest star in the sky, and may be easily seen in broad daylight with the unaided

eye. Its more popular names are Evening star and Morning star. The Greeks called it Hesperus and Phosphorus. Of all the planets, Venus most nearly resembles the earth; it is very nearly the same in size (diameter 7700 miles); its mass is 0.81 that of the earth and it is surrounded by a thick layer of clouds.

VENUS DE' MEDICI, an antique marble statue, now in the Uffizi Gallery, Florence, dating from the



VENUS DE' MEDICI

1st or 2nd century A.D., by an unknown artist. The hair was formerly gilded and the eyes blue. The work is doubtless a distant echo of the *Aphrodite of Cnidus* by Praxiteles, and while it has grace and charm, it is marred by self-consciousness and lack of simplicity. It was found in Rome and brought to Florence in the 16th century. During this trip it was broken into 11 fragments, but was successfully repaired. The forearms and hands are a modern restoration, poorly done.

VENUSIA, or Venosa, an ancient city of Italy in Apulia south of the River Aufidus. The Romans took Venusia from the Samnites in 291 B.C. and made it a military station; situated between two deep ravines, it was a valuable stronghold. After the Battle of Cannae, the shattered Roman army took refuge here. Venusia is the birthplace of Horace.

VENUS OF MILO, a marble statue, by an unknown artist of about 100 B.C., now in the Louvre at Paris. It was discovered in 1820 by a peasant digging a well in the island of Melos (Milo), and has become the most famous of all the surviving statues of antiquity. Both arms are gone, and the body is somewhat battered; but the technique and the expression are incomparable. Some think it is a Victory and not a Venus or an Aphrodite. It is generally considered the most beautiful statue surviving from antiquity.

VENUS'S-FLYTRAP (*Dionaea muscipula*), a remarkable insectivorous plant of the sundew family, native to a restricted area in the vicinity of Wilmington, N.C., and sparingly grown in greenhouses for botanical study. The plant grows about a foot high in moist, sandy, bottom lands bearing several basal leaves and a slender flower-stalk terminating in a cluster of white flowers blossoming in June. The leaves, 2 to 5 in. long and usually about eight in number, are arranged in a spreading rosette near the surface of the soil. Each leaf consists of a flat, expanded stalk and a terminal two-lobed blade fringed with sensitive hairs. The upper surface of the lobes bears highly irritable hairs and numerous crimson glands. When touched by an insect the sensitive hairs cause the leaf to close suddenly like a trap. After a few hours the glands exude a digestive fluid which disintegrates the tissues of the imprisoned insect; the dissolved products are more or less absorbed for

food by the leaf surfaces. See INSECTIVOROUS PLANTS.

VENUS'S-LOOKING-GLASS, a small genus (*Specularia*) of annual herbs of the bellflower family. There are about 12 species, natives of the Northern Hemisphere; four occur in North America. They are low plants with slender stems, alternate leaves and bluish flowers borne mostly in the leaf axils. The common Venus's-looking-glass (*S. Speculum-Veneris*), with bright violet-blue flowers, widely grown in gardens, is a native of the Old World.

VERA CRUZ, a state of Mexico, lying along the coast of the Gulf of Mexico for about 450 mi., and about 50 mi. wide. It has an area of 27,880 sq. mi., and rises from the narrow sandy coast westward to lofty mountains, enclosing many fertile valleys. Among the many peaks that rise to unusual heights are the Cofre de Perote and the Pico de Orizaba, the latter, 18,000 ft. above sea level, one of the highest mountains on the North American continent. Many wide rivers cross the state and empty into the Gulf of Mexico. Among these are the Panuco, Tuxpan, Cosones, Tecolutla and others. The products of Vera Cruz are as varied as its climate and elevation. An almost endless variety of trees, fruits, and tropical plants grows in the lowlands, while the higher elevations produce grains and cereals. In the northern part of the state are the ruins of Misantla, Tusupan, Mapilca and Casones. The capital of the state is Jalapa, and other cities are Vera Cruz, an important port, Orizaba Cordova and Coatzacoalcas. Pop. 1921, 1,159,935; 1930, 1,376,865.

VERA CRUZ, a city of Mexico, situated about 265 mi. southeast of Mexico City. It is one of the important ports on the Gulf of Mexico and has a fine harbor protected by a sea wall more than 6 ft. wide. It has six docks where ships from all over the world are constantly arriving. It is the center of trade for a large surrounding district and most of the exports and imports of southern Mexico pass through this port. Customs duties collected here amount to about a million pesos a year. Fishing is its main industry, with small manufactories of pottery and tobacco. Some of the finest Mexican cigars are made at Vera Cruz.

Its buildings are low and weather-beaten, with wooden or iron balconies. Among these are the cathedral, built in 1734, an artillery school, a hospital and an old convent now occupied by the public library. It was founded by Cortés in the 16th century and was occupied by American forces from Apr. 21 to Nov. 23, 1914. Pop. 1921, 54,225; 1930, 71,989.

VERA CRUZ, SIEGE OF, Mar. 9-29, 1847, the opening engagement of Gen. Scott's campaign in the MEXICAN WAR. By a change of plan in Washington, Gen. Taylor was given leave of absence shortly after the BATTLE OF BUENA VISTA, and Scott in command of 12,000 men was ordered to Vera Cruz, thence to march against Mexico City. The American army landed on Mar. 9, and immediately invested the city, which was defended by about 4,500 troops. On Mar. 22 Scott formally demanded surrender, which

was refused, although the American fleet and artillery completely commanded the city. After four days' terrific bombardment a suspension of hostilities was arranged by the foreign consuls at the port, and on the 29th Vera Cruz surrendered, the Mexicans being allowed to march out with the honors of war.

VERATRUM, a genus of perennial plants of the lily family, commonly known as white hellebore. There are about 12 species, natives of north temperate regions; 7 occur in North America. They are tall perennial herbs with thick, poisonous rootstocks, broad, clasping leaves, and numerous greenish, yellowish or purple flowers in showy terminal clusters. From the rootstocks of the Old World species, *V. album* is obtained the highly poisonous alkaloid veratrin used in medicine as a sedative. The American white hellebore (*V. viride*), found across the continent, with similar properties, is also used medicinally.

VERBENA, a large genus of herbs or subshrubs of the verbena family, some of which are widely cultivated as garden or greenhouse ornamentals for their showy, fragrant flowers. There are 100 species, all except two natives of tropical and temperate America; about 30 occur in the United States. They are mostly diffuse or creeping plants with opposite, usually toothed or deeply cut leaves and medium-sized flowers borne in terminal spikes or heads. The garden verbenas, very popular and of easy cultivation, have been developed during the last 100 years, chiefly from a few South American species. From these have been derived numerous hybrids with handsome flowers ranging in color from red to pink, white, blue, purple or variegated. By gardeners these are classified according to color in three groups: 1. selfs, or one-colored varieties; 2. oculatas, with an eye in the center; 3. Italians, or varieties with striped flowers. *See also* **VERVAIN**.

VERCELLI, a city and archiepiscopal see of northwestern Italy, in the province of Novara, about 45 mi. southwest of Milan. It is famous as the site of Hannibal's initial victory in 218 B.C. It is a busy manufacturing city for a variety of products, but the chief industry is the preparation and export of rice and cereals. Pop. 1931, 39,546.

VERCINGETORIX (-c. 45 B.C.), Gaulish chieftain. He was chief of the Arverni and as leader of the tribes of Celtic Gaul led a great rebellion against Julius Caesar in 52 B.C. His successful defense of Gergovia forced Caesar to raise the siege. Later when the Gauls were defeated at Alesia, Vercingetorix was captured, and exhibited in Caesar's triumph in Rome, then put to death there about 45 B.C.

VERDI, GIUSEPPE (1813-1901), Italian music composer, was born at Le Roncole, Parma, Oct. 10, 1813, the son of an innkeeper. He was a melancholy child, solely interested in music, and learned in one year all that the village organist could teach him. At ten years of age Verdi was himself appointed organist. In 1830 Verdi was granted a small sum for study at the Milan Conservatory. There he was considered destitute of musical ability, and was re-

fused a scholarship. He subsequently studied privately with Lavigna. In 1836 he married, and settled in Milan two years later, struggling to produce his first opera, *Oberto*. Misfortunes beset him in 1839, sickness and poverty being followed by the loss of his wife and two children within three months. Meanwhile, a director clamored for a promised comic-opera, which eventually failed. But his opera *Nabuco*, although wretchedly produced in 1842, immediately won public favor, as did *I Lombardi*, in 1843, and *Ernani* in 1844. Now came a pressing demand for his works. *Luisa Miller* in 1849 was followed by *Rigoletto*, produced in 1851, a supreme operatic triumph, almost equalled by *Il Trovatore*, performed at Rome in 1853. *La Traviata*, appearing in 1853, was the solitary failure in the series of brilliant successes. This possibly resulted from the unfortunate choice of an enormously fat soprano for the rôle of Violetta, whose laments over her approaching death strained the Venetians' sense of humor. Immediate popularity was attained by *Les Vêpres Siciliennes* in 1855, *Un Ballo in Maschera* in 1859, *La Forza del Destino* in 1862, *Don Carlos* in 1867, and *Aida* in 1871. Verdi lived a simple life near Busseto, where his later style was greatly influenced by the work of RICHARD WAGNER. This influence was evident in the *Manzoni Requiem*, in 1874, and reached its height in his operas *Otello*, produced in 1887, and *Falstaff*, produced in 1893. Verdi died at Milan, Jan. 27, 1901.

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VERDIGRIS, a basic acetate of copper obtained by the oxidation of copper plates separated by cloths saturated with acetic acid. It is used as a pigment in green paints, in the manufacture of Paris green, and in medicine, as a caustic or liniment. Verdigris is an irritant poison, the best antidote being white of egg and milk.

VERDUN, a city in the St. Ann electoral district, Quebec, Canada, situated on the St. Lawrence River, at the foot of the Lachine Rapids, and within the southwestern boundaries of Montreal although remaining an independent municipality from that city. Verdun is principally a residential suburb, notwithstanding several mills, a dyeing plant and a cigar factory. A riverfront boardwalk over 2 mi. long is beautified by gardens, playgrounds and parks, and there is a particularly fine World War memorial. An airport serves the city. With many French-Canadian inhabitants, it is named after the French city of Verdun, and was incorporated as a village in 1874. Pop. 1921, 25,001; 1931, 60,745.

VERDUN, SIEGE OF, a prolonged offensive by the Germans from Feb. 21, to June 15, 1916, during the World War. The failure of the Germans to capture the fortress system of Verdun, which blocked the road to Paris, materially weakened their morale. Warned by the ease with which the Germans demolished the forts of Liège and Namur in 1914, the French had greatly strengthened Verdun and planned it as an auxiliary to a trench army. While the Ger-

mans were aware of these changes, the high command believed that the deadlock on the western front could only be broken after Verdun was razed. The task was given to the Crown Prince Frederick William. Before the offensive the Germans had 18 divisions to launch against Verdun, and near the end employed 43½ divisions. The Allies used 66 divisions. The offensive began on Feb. 21 with a German bombardment which eclipsed any deluge of shells known up to that time. Heavy artillery pulverized the 25-mile front from the Bois d'Avocourt to Étain, and the Germans effected a break-through in the Bois d'Hau-mont. By Feb. 24 the Germans had captured the outer French positions. At the close of the 24th the German advance caused such concern among the Allied commanders that Gen. Pétain was placed directly in command. At this juncture the German right had enveloped Champneuville, the center had taken Beaumont, and the left captured Ft. Douaumont on the 25th. While the Germans paused, Pétain mapped out a battle plan. On Mar. 6 the Crown Prince returned to the attack, and instead of losing impetus, the successive German attacks increased in intensity and determination. By Apr. 8th the Germans were attacking Hill 304 northwest of Verdun, thus threatening the lines of communication with Paris. A total area of 150 square miles had been gained by the beginning of May, although the average German advance did not much exceed three miles. A great French counter-offensive was launched on Nov. 29; by Aug. 21, 1917, after a year's struggle, the French won back all the lost ground except Beaumont.

VERDUN, TREATY OF, a peace pact signed Aug. 10, 843, by the three Frankish kings, Louis the German, Charles the Bald and the Emperor Lothair, all grandsons of Charlemagne. Under its terms Louis obtained the territory east of the Rhine; Charles was awarded the land between the Pyrenees and a line which, starting from the mouth of the Scheldt in the north, ran approximately due south along the course of the Meuse, Saône and Rhone rivers; and Lothair received the Italian kingdom of Lombardy together with the remaining strip between West Francia (France) and East Francia (Germany). The Verdun document was supplanted in 870 by the Treaty of Mersen, under which Lothair's territory north of the Alps, which Lothair II, his son, had inherited in 855, was divided between the kings of East and West Francia. From Lothair II the name Lotharingia, or Lorraine, was derived. The Territory has been a bone of contention in Europe for more than 10 centuries.

VEREENIGING, PEACE OF, the terms of peace, drawn up by Boer and British delegates at Vereeniging in the Transvaal, South Africa, in May 1902 and signed at Pretoria on May 31, which officially ended the BOER WAR. The treaty was liberal to the Boers in its general tenor, and contained provisions for the repatriation of all burghers who would take the oath to Edward VII. It also provided that

the Dutch tongue should be taught in the schools if the Boers should so decide and that the replacement of military government by civil government within as short a time as possible would be but a step toward eventual Boer autonomy.

VERENDRYE, a national monument situated in northwestern North Dakota, marks a spot associated with the explorations of the celebrated French explorers of the name of Verendrye who were the first white men to enter North Dakota and to journey into the interior of the northwest. A tract of 250.04 acres was established as a national monument June 29, 1917. It includes the picturesque Crowhigh Butte which rises 565 ft. above the left bank of the upper Missouri and was the site of the Verendrye camp in May 1742, 60 years before the first Lewis and Clark expedition. The town of Spanish North Dakota, which adjoins the monument, is served by a branch line of the Chicago, Milwaukee and Sault Ste. Marie Railroad. It may also be reached by automobile from Stanley, N.D., which is about 20 mi. northwest on the Theodore Roosevelt International Highway.

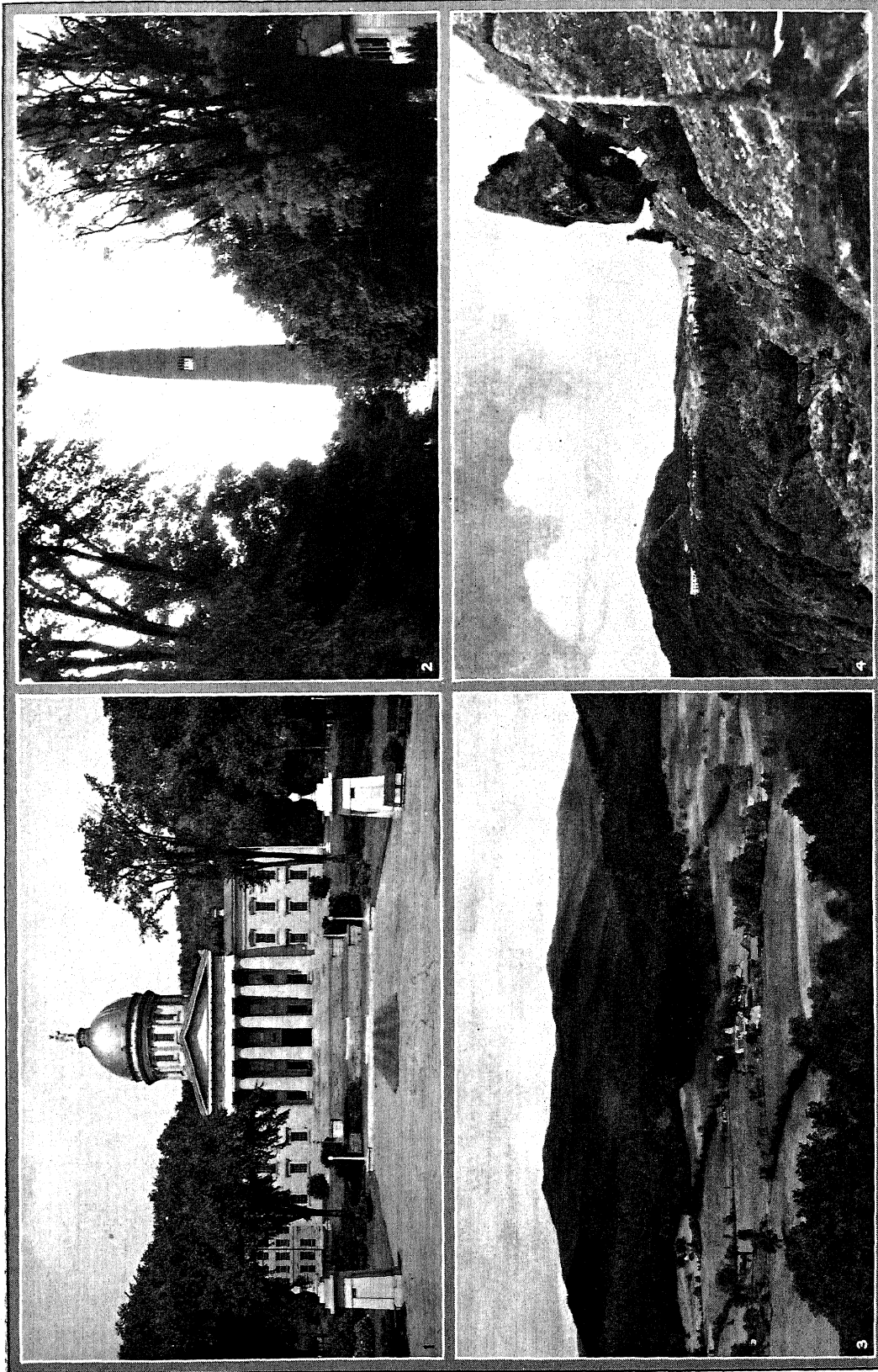
VERGA, GIOVANNI (1840-1922), Italian novelist, was born in Catania, Sicily, Aug. 30, 1840. He is famous for his realistic novels of peasant life in Sicily and ranks as one of the founders of the naturalistic school of fiction in Italy. His best known novels are *I Malavoglia*, 1881, and *Maestro Don Gesualdo*, 1889. The libretto for Mascagni's *CAVALLERIA RUSTICANA* was taken from one of Verga's short stories. Verga died in Rome, Jan. 27, 1922.

VERGER, an official who carries a verge, mace or similar insignia before a scholastic, legal or church dignitary. In English cathedrals and collegiate churches, he is one who carries the mace before the dean or canons, also one in charge of a cathedral or church, especially one who acts as usher. Sometimes the term is used as a title for **SEXTON** or **SACRISTAN**.

VERGIL (70-19 B.C.), Roman poet, whose full name was Publius Vergilius Maro, was born at Andes, near Mantua, Oct. 15, 70 B.C. The son of a plebeian in modest circumstances, he studied rhetoric and philosophy at Cremona and Naples, and in 53 B.C. went to Rome, where he continued his education. He lost his paternal estate twice, in 41 and 40 B.C., when Octavian distributed the land among his soldiers, but recovered it through the intercession of his friends and patrons, especially Asinius Pollio. Vergil was highly esteemed by the most celebrated men of his day. **HORACE** was his intimate friend; **MAECENAS** and Octavian, later the Emperor **AUGUSTUS**, were his chief patrons. The material aid of the latter enabled him to live in comfort and devote himself entirely to poetry. Vergil died at Brundisium Sept. 21, 19 B.C., while returning from a journey to Athens. His remains were buried at Naples. The poet was of a weak physique, awkward and bashful, but his gentleness, amiability and sincerity made him an extremely popular figure.

The earliest, authentic, extant poems of Vergil are his 10 *Bucolica*, or *Pastoral Poems*, also called

VERMONT



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HISTORICAL AND SCENIC VIEWS OF VERMONT

1. State House, built of Vermont granite, at Montpelier, the capital city. 2. Monument, 310 ft. high, at Bennington, commemorating the Battle of Bennington in the American Revolution, August 16, 1777. 3. The village of Plymouth, birthplace of President Coolidge. 4. Summit of Mount Mansfield, 4,393 ft. high.

VERMONT

Area 9,564 sq. m.
Pop. 359,611

PRINCIPAL CITIES

Pop. Thousands
1 Arlington, P 7
3 Barre, P 15
11 Barre, G 13
1 Barton, C 16
4 Bellows Falls, O 14

7 Bennington, C 6
Berkshire, A 10
Berlin, G 13
Bethel, H 11
Brattleboro, Q 13
Bristol, H 11

25 Burke, D 12
Burlington, E 6
Castleton, L 6
Cavendish, M 12
Charlotte, F 5
Chelsea, J 14

6 Colchester, F 5
Craftsbury, D 14
Danville, F 17
Dorset, Z 7
1 East Montpelier, F 13
1 Enosburg Falls, B 10

2 Essex Junction, B 10
1 Fairfax, C 13
Fairfield, C 13
Fair Haven, C 13
1 Ferrisburgh, G 5
1 Franklin, A 9

1 Georgia, C 7
1 Graniteville, C 13
2 Hardwick, B 14
Hartford, K 15
1 Hartland, B 14
Highgate, B 14

1 Hinesburg, B 14
2 Island Pond, C 20
2 Ludlow, M 11
1 Lunenburg, E 21
1 Lyndon, E 18
2 Lyndonville, E 18

2 Middlebury, H 6
1 Montpelier, B 12
1 Montgomery, B 12
8 Montpelier, G 12
2 Morrisville, D 12
1 New Haven, H 7

5 Newport, B 16
2 Northfield, H 11
1 N. Troy, A 14
1 Norwich, F 15
1 Orleans, C 16
1 Pawlet, N 6

2 Poulney, L 6
1 Pownal, K 6
1 Proctor, K 6
2 Randolph, I 11
2 Richmond, A 11
5 Rochester, J 10

5 Rockingham, O 13
2 Royalton, J 12
7 Rutland, L 8
8 St. Albans, C 7
8 St. Johnsbury, E 18

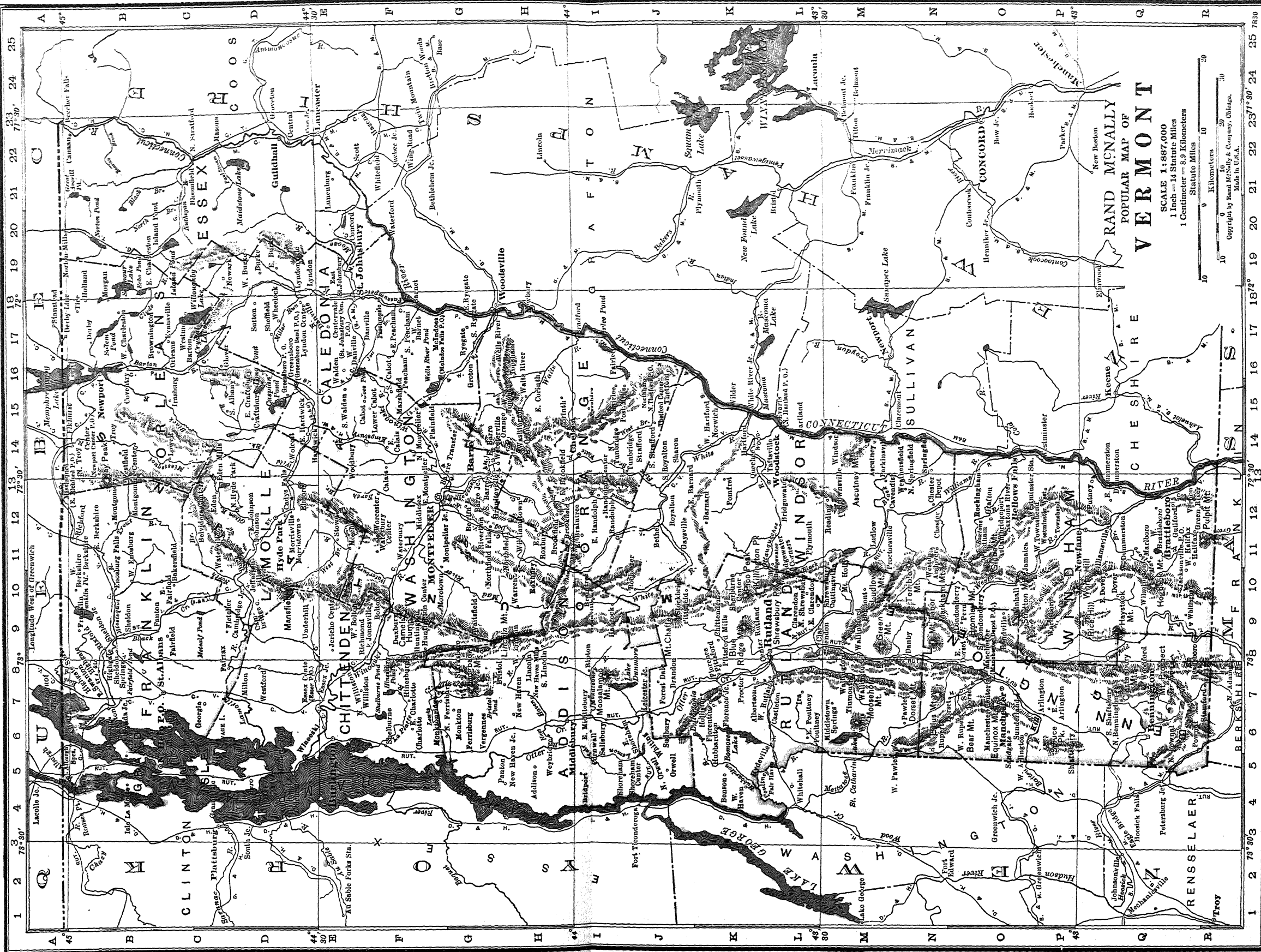
2 Shaftsbury, P 6
1 Shelburne, F 6
1 Sheldon, B 6
13 Royalton, J 13
5 Springfield, N 13
5 Swanton, B 7

1 Thetford, J 16
3 Troy, B 14
2 Vergennes, G 5
2 Wallingford, M 8
2 Waterbury, F 11
1 Weathersfield, M 14

1 West Rutland, L 8
3 White River Junction, K 15
1 Wilder, K 15
2 Williamstown, H 12
1 Williston, E 7

4 Windsor, M 14
1 Woodstock, E 6
1 Woodstock, L 13

Pop. Hundreds
9 Bakersfield, C 10
9 Canaan, A 23
9 Grand Isle, C 5
9 Moretown, G 11



RAND McNALLY
POPULAR MAP OF
VERMONT

SCALE 1:887,000
1 inch = 14 Statute Miles
1 Centimeter = 8.9 Kilometers

Statute Miles
Kilometers
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Eclogues, which were written between the years 42-37 B.C. These are modeled after the idylls of THEOCRITUS, but while the pastoral background is preserved, Vergil's figures are allegorical rather than natural. The *Georgics*, a didactic poem in four books, undertaken at Maecenas's instance, was completed in 30 B.C., after having occupied him 7 years. It deals with the agricultural occupations, and the poet's object is to bring back these pursuits to their ancient honor. Vergil clothes his prosaic subject in rich warm colors; the movement of the poem is smooth and dignified, the language of the utmost purity. In the minds of most scholars, the *Georgics* is perhaps the most perfect, certainly the most artistic, poem in Latin literature. Vergil's great national epic, the *AENEID*, in 12 books, was not completed. It was his original intention to have the unfinished poem destroyed, but it was nevertheless published by his friends, by whom it was carefully revised. It relates the adventures of AENEAS after the fall of TROY, his arrival in Italy and the founding of Rome. It imitates both the *ODYSSEY* and *ILIAD* of Homer, and is like them written in hexameter verse. Because of its glorification of the Roman people, it was received with wild enthusiasm by the latter. It is no doubt a great work, but it perhaps lacks the artistic completeness of the *Georgics*.

Vergil's fame as a poet was immediate and permanent. His works were widely read in the schools, and his influence on the later Roman literature and language was unsurpassed. During the Middle Ages his name was surrounded by a number of fantastic legends; he was held to be a magician and miracle-maker. In the *DIVINE COMEDY*, Vergil appears as Dante's guide through the infernal regions. Time has not altered his position as the most famous of the Latin poets. See also LATIN LITERATURE.

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VERHAEREN, ÉMILE (1855-1916), Belgian poet, was born near Antwerp, May 21, 1855. He studied at Ghent and the University of Louvain, and later edited several literary and esthetic reviews, espousing particularly the cause of impressionism in literature and art. His early poetical collections, especially *The Flemings*, 1883, and *The Monks*, 1886, are characterized by a vigor and vitality of expression that force comparison with the poetry of WALT WHITMAN. Among his other works are *Toute la Flandre*, 1904-11, and *Les heures du soir*, 1911. The unusual qualities and intense patriotism of Verhaeren's poetry have served to make him known as the national poet of Belgium. He died at Rouen, Nov. 27, 1916.

VERIDICAL, a term extended to many a phenomenon investigated in PSYCHICAL RESEARCH which though apparently supernatural is regarded or proven to be in accord with fact. A premonition of a dream that comes true is said to be veridical.

VERISSIMO, JOSÉ (1857-1918), Brazilian scholar and critic, was born at Belem, Para, Apr. 8, 1857. He began his career as a public official in his native province, but soon made his way to the directorship of the Gymnasio Nacional, and later of the Normal School of Rio de Janeiro. For a long time, concurrently with his scholarly labors, he edited the famous *Revista Brasileira*. His *Scenes of Life on the Amazon* have been compared for their exotic charm to the pages of PIERRE LOTI. Verissimo is the finest critical mind that Brazil has yet produced in letters; he is distinguished for his originality, his independence and his strict esthetic ideals. His outstanding works are *Estudos de literatura brasileira*, *Historia da literatura brasileira* and *Que e literatura*. He died in 1918.

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VERLAINE, PAUL (1844-96), French poet, was born at Metz, Mar. 30, 1844. His first volume, entitled *Poèmes Saturniens*, appeared in 1866. In 1871 he met JEAN ARTHUR RIMBAUD, whose influence did much perhaps to mar his life. With Rimbaud he wandered in France, England and Belgium, and in the latter country he was imprisoned for 2 years at Mons, as a result of accidentally shooting his friend. After his release he went to England, where for a time he taught French in a boys' school. He returned to France and for the rest of his life lived a poverty-stricken existence, fortunately gaining recognition of his genius before his death. *Sagesse* and *Romances Sans Paroles* show him at his height as a poet. Verlaine died in Paris, Jan. 8, 1896.

VERMICIDES. See ANTHELMINTHICS.

VERMILION, a city on the southeastern boundary of South Dakota, the county seat of Clay Co. It is situated on the Missouri and Vermilion rivers, 40 mi. northwest of Sioux City and served by buses, trucks and the Chicago, Milwaukee, St. Paul and Pacific Railroad. Vermilion is a trade center in an agricultural region, and the seat of the UNIVERSITY OF SOUTH DAKOTA, established by the first territorial legislature and opened in 1882. The city was an old trading post; the first settler built his home on this site in 1857. Vermilion was incorporated in 1877. Pop. 1920, 2,590; 1930, 2,850.

VERMONT, one of the New England States of the United States popularly called the "Green Mountain State." It is situated between 42° 44' and 45° 1' N. lat. and 71° 33' and 73° 25' W. long. On the north it is bounded by the Canadian province of Quebec, on the east by New Hampshire from which it is separated by the Connecticut River, on the south by Massachusetts and on the west by New York and Lake Champlain. Vermont comprises an area of 9,564 sq. mi. inclusive of 440 sq. mi. of water surface, with an extreme length of 158 mi. from north to south and a breadth of 41 to 90 mi. from east to west. In size Vermont ranks forty-second among the states of the Union.

Surface Features. Vermont lies directly in the path of the chain of Appalachian Mountains which carries over into New England. Within the state the

mountains are known as the Green and Taconic, the latter range occurring in the southwestern part. They cover practically the whole surface, while the remainder is exceedingly rugged.

The north and south range of Green Mountains have a prevailing height of 2,000 ft. above sea level although there are numerous peaks which rise above 3,000 and 4,000 ft. Mt. Mansfield, 4,393 ft. high, in Lamoille Co., is the maximum elevation. The mean altitude for the state is 1,000 ft. above sea level, and the low point is 95 ft. on the level of Lake Champlain.



VERMONT STATE SEAL

In Vermont the details of topography are due chiefly to glaciation. Numerous small lakes exist in ice-scoured basins, and the thin mantle of rock strewn soil is of morainic origin. Of the principal rivers, the Otter, LaPlante, Lamoille and Missisquoi flow into Lake Champlain, and the West, White, Black and Passumpsic into the Connecticut.

Climate. With severe and prolonged winters and cool summers, the climate of Vermont is generally healthful and agreeable. At Northfield, near the center of the state, the mean annual temperature is 41.4° F., ranging from a mean of 15.2° F. for January to 65.9° F. for July, with an average annual precipitation of 33.8 in. including 87.3 in. of snow. Cooler weather characterizes the eastern part as compared with the western section. A temperature of -36° F. has been recorded at Woodstock. The average date for the last killing frost in spring at Northfield is May 22 and that of the first killing frost in autumn is September 18, giving an average growing season of 120 days.

Forests and Parks. Practically the entire land area of Vermont was originally forested with excellent stands of both hardwoods and conifers. In a 1929 estimate the forest area covers 3,427,418 acres or approximately $\frac{2}{3}$ of the area. At least 80% of this acreage is in pure hardwoods and 3% is pure white pine. The principal trees are white pine, spruce, hemlock, balsam fir, maple, birch, beech and basswood. State forests and state parks are administered by the State Commissioner of Forestry. There are 15 state forests with a total area of 32,597 acres and 3 state forest parks with an area of 1,492 acres. Forests and parks contain hundreds of beautiful lakes. They are developed for recreation as well as timber production and have camping facilities, trails and roads. Battell Forest donated to Middlebury College by Joseph Battell is a 30,000-acre tract in the high summits of the Green Mountains and contains many acres of primeval spruce forest. According to the will of Colonel Battell 10,000 acres must always be reserved as a park. Ver-

mont cooperates with the Federal Government under the Clarke-McNary Law and in 1930 in addition to an appropriation for fire protection 1,825,700 trees were distributed for forest planting on farm and state lands.

Minerals and Mining. The outstanding mineral resources of Vermont are its extensive beds of monumental granite, quarried chiefly at Barre; of excellent marble, found in Rutland county; and of variously colored slate, which occurs along the western border of the state.

With mineral productions in 1929 amounting to \$14,602,589, Vermont stood thirty-sixth among the states, ranking second in granite, slate, marble and asbestos. The principal products were stone, 367,240 tons valued at \$9,435,680, including granite \$3,892,352, and marble \$1,829,315; and slate \$3,704,894. Among minor products were talc valued at \$546,658; lime, \$505,246; sand and gravel, \$58,879; and asbestos, \$47,799. During 1929 129 mines and quarries gave employment to 3,466 persons who received \$4,936,528 in salaries and wages.

Soil. Prevailing of glacial origin and derived chiefly from the disintegration of granitic and gneissic rocks, the soils of Vermont are in general stony, sandy and sterile. However, in the valleys and on some of the lower hills, especially in the western section adjacent to Lake Champlain, the soils composed of mixed clays and sand are fertile and produce abundant crops.

Agriculture. Hay, forage and grain, utilized largely in the dairy industry, constitute the principal crops.

In 1930 3,896,097 ac. or 66.7% of the entire land area was in farms, 24,898 in number, with an average size per farm of 156.5 ac. and an average value per acre of \$37.46. Of the farm area 1,128,017 ac. was crop land; 2,191,671 ac., pasture land; and 485,931 ac., woodland. The total value of farm property was \$202,847,735, of which \$145,935,241 was represented by land and buildings; \$20,776,501, by implements and machinery; and \$36,135,993, by domestic animals.

According to the census of 1930 Vermont produced in 1929 field crops to the value of \$23,699,789, ranking forty-fourth among the states. The chief crops were hay and forage, 1,141,206 tons, \$14,674,451; vegetables, \$3,866,679; fruits, \$1,649,808; and grain, \$1,277,482. The chief vegetable crop was potatoes, valued at \$2,519,990; the leading fruit grown was apples, 975,014 bu. Among the grains were oats, 1,010,660 bu., and corn, 259,170 bu.

Farm products sold by cooperative marketing rose from \$1,449,389 in 1919 to \$6,807,273 in 1929, and farm supplies purchased by this method from \$510,305 to \$1,512,633. Farm machinery and equipment in 1930 included 18,620 automobiles, 5,035 motor trucks, 2,426 tractors, 3,645 electric motors and 10,962 stationary gas engines.

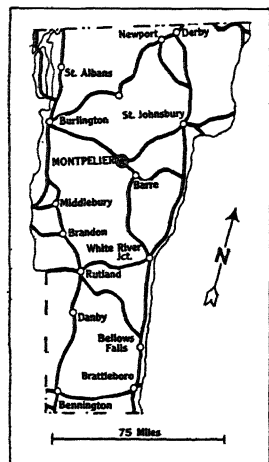
Animal Industry. Dairying is the chief livestock interest. According to the census of 1930, Vermont ranked thirty-ninth among the states in total value, \$36,135,993, of domestic animals on farms. Among these were cattle 472,233 valued at \$28,572,638; horses

52,279, \$5,727,013; mules, 524, \$57,370; swine, 29,432, \$434,872, and sheep, 51,175, \$428,803.

Of the cows on farms, 309,609 were kept mainly for milk production and 2,924 mainly for beef production. In 1929, 139,075,554 gals. of milk were produced; the total value of dairy products marketed was \$29,182,220, including \$23,817,128 for whole milk sold. The value of all poultry raised, chiefly chickens, was \$1,984,966; the chickens sold were valued at \$894,985. Of 6,679,751 doz. chicken eggs produced, valued at \$2,704,261, 4,354,376 doz., with a value of \$1,764,383, were marketed.

Fisheries. There is no commercial fishing in Vermont, but the lakes and streams of the Green Mountains offer good trout fishing to the sportsman. In 1930, the state issued 60,530 fishing licenses and received \$86,859 in fees. In 1930 five fish hatcheries were operated at a cost of \$42,914, from which 1,800,000 trout, 13,275 bass and 23,700,087 commercial species were put out. In addition, heavy plantings in state waters by the U.S. Bureau of Fisheries included 74,800,540 yellow perch, 15,000,000 pike perch, 1,165,118 brook trout, 90,000 lake trout, 45,000 landlocked salmon and 23,000 other game fish. There are Federal egg collection and hatching stations at Pittsford and St. Johnsbury.

Transportation. Steamers on Lake Champlain afford regular service to its bordering towns. With its outlet, the Richelieu River, Lake Champlain, connected with the Hudson River by a canal, provides a waterway from the St. Lawrence River to New York City. Other transportation by water is negligible.



VERMONT STATE ROADS

In 1930 the total railway mileage of the state was 1,057, with the Rutland, the Central Vermont and the Boston and Maine the most important lines. While these roads do not afford adequate transportation, they are rapidly being supplemented by bus and trucking organizations, which penetrate the regions not served by the railroads.

On Jan. 1, 1930, there were 20,025 mi. of highways in Vermont, including 4,983 mi. of surfaced roads and 3,485 mi. of improved state highways.

During 1929, highway expenditures were \$13,361,124, of which \$12,516,284 was paid by the state and \$844,840 by county and local governments. Gasoline consumption during 1930 aggregated 46,998,000 gals. The state gasoline tax that year produced an income of \$1,879,921 as against \$533,093 in 1926. Motor vehicle registrations were 86,624 in 1930 compared with 69,576 in 1925. The rapid growth of transportation by truck is indicated by registrations, which rose from 5,010 in 1925

to 8,226 in 1930, or over 60%. During the same period the number of buses in operation increased from 198 to 309, or more than 50%.

Manufactures. Manufacturing in Vermont is based largely on its quarry, farm and forest resources. According to the census of 1930 Vermont with manufactures for 1929 valued at \$143,522,547 stood forty-second among the states. Its 927 establishments gave employment to 3,119 officers and employees, who received \$8,136,403 in salaries, and to 27,421 wage earners, who were paid \$33,809,987 in wages. These factories used a total of 163,940 horse power, expended \$3,435,438 for fuel and power, and \$62,827,435 for material and supplies, and added by the process of manufacture \$77,259,674 to the value of their output.

In the output there were 33 separately enumerated industries. Among the most important of these in order of value were marble, granite, slate and other stone products, \$23,131,193; machine tools, \$13,971,445; feeds for animals, \$12,581,724; paper, \$7,825,657; lumber, \$7,291,438; woolen goods, \$7,191,773; knit goods, \$4,606,082, and furniture, \$3,622,891.

The chief manufacturing cities with value of output were Burlington, \$12,077,671; Barre, \$9,803,296, and Rutland, \$6,550,057.

Commerce. According to the census of 1930, there were in 1929 308 wholesaling establishments in Vermont, with total sales of \$57,392,926. These organizations gave full-time employment to 1,933 men and women, whose annual salaries and wages aggregated \$2,899,256.

The total sales of the 5,169 retail stores amounted to \$152,074,734. Sales per store averaged \$29,420; sales per capita were \$422.89.

CHIEF RETAIL DISTRIBUTING GROUPS

Group	No. of Stores	Sales	% of Total
Automotive	1,088	\$35,694,140	23.46
Food	1,230	31,641,149	20.82
General Mdse.	791	27,537,372	18.12
Lumber & Bldg.	305	12,429,000	8.17
Apparel	342	9,493,110	6.25
Furn. & Household ..	180	5,361,824	3.51
All other stores	1,233	29,918,139	19.67
Total, all stores ...	5,169	\$152,074,734	100.00

Finance and Banking. The assessed value of all taxable property in 1929 was \$283,088,284. In 1930 the total bonded debt was \$9,578,531, of which \$8,075,000 represented bonds issued after the floods of 1927. Total state revenues in 1929 were \$10,506,028; total disbursements, \$16,289,997, due to extraordinary payments for the repair of flood damage. The chief sources of income were property taxes, \$3,150,000 and taxes on corporations, motor vehicles and gasoline, \$1,157,155. The principal payments were for highways, \$11,907,915, education, \$517,940 and debt service, \$289,092.

There were 104 banks in Vermont in 1930. Of these, 45 were national banks and 59 trust companies and state banks. Their total capitalization was \$7,961,000; their surplus and undivided profits, \$22,575,000.

Total resources were \$277,153,000, with loans and discounts aggregating \$155,098,000. Demand and time deposits totaled \$232,166,000. Per capita demand and time deposits were \$646.70; per capita savings deposits, \$569.87. The total savings of \$204,585,000 were owned by 327,634 depositors. National bank circulation aggregated \$4,270,000.

Government. The legislative body of Vermont, known as the General Assembly, consists of a Senate composed of 30 members and a House of Representatives of 248 members, all elected for terms of two years, and meeting in biennial sessions unlimited in duration. The chief executive is the governor elected for terms of two years at a salary of \$3,000 per year. Other executive officers are the lieutenant governor, treasurer, secretary of state, and auditor. Judicial power is vested in a supreme court, a superior court, and in county, probate, city, and municipal courts. The supreme court consists of five judges chosen by the legislature for terms of two years. The chief justice receives a salary of \$5,500 per annum and the other judges salaries of \$5,000 a year.

Social Welfare Institutions. There is a school for feeble-minded children at Brandon and an industrial school for delinquent boys and girls at Vergennes. At Montpelier is the Kinstead Receiving Home for dependent and neglected children. The hospital for insane is at Waterbury. The state pays for tuberculous patients at the Washington County Hospital at Barre, it also pays for the care of undernourished or tuberculous children at the Caverly Preventorium at Pittsford. The Brattleboro Retreat is a private sanitarium where the state pays for the care of the insane. At Windsor are the prison and house of correction for men; like institutions for women are at Rutland. The Department of Public Welfare has supervision of the state welfare institutions.

Education. The first school of which any record has been left was operated at Guilford in 1761. In 1763 it was voted to erect 3 schoolhouses in Bennington. The constitution of 1777 provided for the opening of a school in each town. In 1927-28, there were 2,100 public elementary schools having 53,511 enrolled pupils and 2,361 teachers. In the 94 public high schools, there were 11,018 pupils and 557 teachers. Children from 8 to 16 years of age are required to attend school 150 days of the year.

The number of persons from 5 to 20 years of age attending school in 1930 was 74,617, or 70.4% of the population within the ages specified, as compared with 67,746, or 67.2%, in 1920. The number of persons 10 years and over, unable to read or write in 1930 was 6,299, or 2.2%, as compared with 8,488 illiterates, or 3%, in 1920. Foreign-born white illiterates numbered 3,005, or 7.2% in 1930, and 4,837, or 11.3% in 1920.

The institutions of higher learning maintained by the state include the University of Vermont and State Agricultural College at Burlington, and normal schools at Castleton, Johnson and Lyndon. Other educational institutions are Norwich University at Northfield, Middlebury College at Middlebury, and St. Michael's

College at Winooski. The Free Public Library Department, State Board of Education, has its headquarters in Montpelier.

Population. In 1930 Vermont ranked forty-fifth among the states with a population of 359,611 or an average of 39.4 per sq. mi., an increase of 7,183 or 2% over 1920. The population rose from 85,425 in 1790 to 314,120 in 1850, 343,641 in 1900, 355,956 in 1910, and 352,428 in 1920. In 1930 there were 358,965 or 99.8% whites and 568 or 0.2% Negroes. Of the whites 315,904 were native-born and 43,061 were foreign-born. Of the total foreign stock, including foreign-born and foreign and mixed parentage, 46,956 or 37.6% were Canadian French and 27,067 or 21.7% other Canadians. The rural population was 240,845 or 67% of the total, a decrease of 1,607 or 0.7% from 1920; the urban population was 118,766 or 33% of the total, an increase of 8,790 or 8% since 1920. In 1930 the three largest cities were Burlington, 24,789; Rutland, 17,315; Barre, 11,307.

Occupations. In 1930 141,203 persons, or 39.3% of the population, were gainful workers 10 years old or older; 79.9% of these were males and 20.1% were females; 84.0% were native white, and 15.8% foreign-born white. Among the chief occupations, with number of workers, were manufacturing, 41,450; agriculture, 38,114; domestic and personal service, 13,887; trade, 13,710; transportation and communication, 11,310, and professional service, 9,181.

HISTORY

CHAMPLAIN on July 4, 1609, entered the lake which bears his name. The adjacent country was then inhabited by Iroquois tribes, but in 1665, when the French built the first settlement in Vermont, Ft. St. Anne on Isle la Motte, the region was occupied by Algonquins. The first English settlement, Ft. Dummer, built in 1724 on the site of Brattleboro, was opposed by French forts built at Chimney Point and Crown Point in 1730-31, and English traders were menaced by French soldiers. Vermont was a warring frontier until 1758, when with the loss of Isle aux Noix the French were completely ejected. Emigration into Vermont, beginning in earnest in 1760, heightened the dispute over sovereignty in the region between NEW HAMPSHIRE, which claimed as its western boundary "a line twenty miles east of the Hudson River," and New York, which claimed to be "bounded eastward by the Connecticut River." In 1764 the king in council decided in favor of New York. The New York government, holding that the decision invalidated grants made by the governor of New Hampshire, ordered the settlers to repurchase from New York. The GREEN MOUNTAIN BOYS and other spirited expressions of protest promoted regional pride and the desire for independent provincial existence. In April, 1775, a convention at Westminster proclaimed the territory independent of New York. During the Revolution, while Ethan Allen, Seth Warner, and other military leaders waged practically a separate war against the British and Indians, Ira

Allen, Jonas Fay, and others were responsible for a convention at Westminster, Jan. 15, 1777, which announced "a free and independent state" to be called New Connecticut. The name was found to have been already used in the Susquehanna Valley, and was abandoned for Vermont. In 1790 New York agreed through authorized commissioners to cease opposition to the movement for statehood on payment of \$30,000 for disputed land claims, and on Mar. 3, 1791, Vermont became the 14th state of the Union. Its population was then 85,525. Montpelier, the capital, was established in 1808 as the geographical center of the state.

Vermont contributed 4,170 regulars to the War of 1812 and 4,170 additional volunteers to the notable engagement near its border (see PLATTSBURG, BATTLE OF); 35,242 of its citizens served in the Civil War. By 1830 the population of the state had become fairly stabilized. In late years a French-Canadian immigration into Vermont has been conspicuous.

Long a Republican stronghold, Vermont resisted Democrat inroads, and in 1932 returned Stanley C. Wilson as governor and Porter H. Dale as senator.

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VERMONT, UNIVERSITY OF, at Burlington, Vt., a coeducational state institution chartered in 1791. In 1865 the Vermont Agricultural College was incorporated with the university, after which the institution received the benefits of the Federal Land Grant Act. The university is composed of colleges of Arts and Sciences, Engineering, Agriculture and Medicine. It had productive funds in 1931 amounting to \$1,626,000. Billing Library, containing approximately 128,000 volumes, includes special collections on Vermont History, Civil War History and the George P. Marsh Collection on Philology. In 1931-32 there was a student enrollment of 1,271, and a faculty of 197, headed by Pres. GUY W. BAILEY.

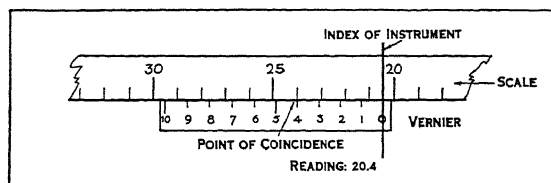
VERNE, JULES (1828-1905), French writer, was born at Nantes, Feb. 8, 1828. Although educated for the law, he soon turned to writing. He gave his attention first to verse comedy, but soon discovered his true vein in the original type of highly imaginative scientific romance which he made famous. His *Cinq Semaines en Ballon* was published in Hetzel's *Magazin d'Éducation* in 1862, and thenceforth his books followed in quick succession during a quarter-century. Among Verne's most celebrated tales, all popular in English, are *The Mysterious Island*, *Twenty Thousand Leagues under the Sea*, 1869, *From the Earth to the Moon*, *Around the World in Eighty Days* and *Michael Strogoff*. A knight of the Legion of Honor, Verne died at Amiens, Mar. 24, 1905.

VERNER'S LAW, a PHONETIC LAW discovered in 1876 by the Dane, Karl Verner. It explains certain apparent irregularities in the operation of GRIMM'S LAW, by showing that INDO-EUROPEAN *p*, *t*, *k* become GERMANIC *f*, *th*, *ch* only when initial or when the vowel immediately preceding them was accented in the Indo-European period; otherwise they become the

corresponding voiced spirants *v*, *dh* (written *th*), and *gh* (written *g*) respectively. Under like conditions, moreover, Indo-European *s* becomes *z* (*r* in West and North Germanic). Examples are Sanskrit *pitár*, "father," Gothic *fadar*, Old High German *fater*, but Sanskrit *saptá*, English *seven*, German *sieben*; Sanskrit *bhrátar*, "brother," Gothic *brothar*, German *bruder*, but Sanskrit *pitár*, Gothic *fadar*, Old High German *fater*; Sanskrit *çatám*, English *hund-red*, German *hund-ert*, but Sanskrit *çvacrú* for **svacrú*, Old High German *swigar*, "mother-in-law"; Sanskrit *sūnú*, English *son*, German *sohn*, but Sanskrit *bhárase*, Gothic *bairaza*, "thou carriest," Sanskrit *snushā*, Old High German *snur*, "daughter-in-law," this also accounting for such phenomena as English *was* : *were*. The effect of Verner's Law is seen in the varying pronunciation of *s* in English *possess*, the *s* preceding the stressed syllable being sounded as the voiced *z*, but the *s* succeeding the stress as the voiceless *s* (cf. also the difference in English *ánxious* and *anxiety*). It also appears in certain cases in ROMANCE, as in French *fásse* : *faisóns*, Italian *débbo* : *dovémo*. E. Ro.

BIBLIOGRAPHY.—K. Verner, "Eine Ausnahme der ersten Lautverschiebung," in Kuhn's *Zeitschrift*, xxiii, 1876.

VERNIER, an auxiliary scale used with linear or angular scales to enable them to be read more accurately than their subdivisions would otherwise permit. The vernier is moved so that its index, the



VERNIER SCALE

zero, coincides with the point at which the index of the instrument falls on the scale. Then, a fraction of a subdivision on the scale is indicated on the vernier at the point where one of its division lines coincides with one on the scale. In the figure: The index of the instrument falls between 20 and 21, and on the vernier the line at 4 coincides with a line on the scale. Thus, the reading is 20.4.

The vernier scale is divided into the number of divisions desired in reading between subdivisions on the main scale, as 10, and its total length is equal to the total length of one more or less than that number of divisions on the main scale, as 9 or 11. Nine is used in the figure; had eleven been used, the vernier scale divisions would have been numbered from left to right.

VERNON, a city and the county seat of Wilbarger Co. in western Texas; situated on the Pease River, 50 mi. northwest of Wichita Falls. Bus lines, two railroads and an airport serve the city. Oil and gas are produced in the vicinity; cotton is the principal crop, and cotton products and flour are the important manufactures. The city was founded about

1880, incorporated in 1889, and became a chartered city in 1916. Pop. 1920, 5,142; 1930, 9,137.

VERONA, a city of northern Italy, capital of the province of the same name, situated on both banks of the rapid Adige, at the entrance to the highroad toward the Alps. Its history from Roman days has been influenced by this strategic situation. The city wall with bastions was built by Sammicheli, whose public buildings combine the severity of the fortress with the grace of the Doric style and the traces of whose genius appear in many palatial edifices. The Piazza del Erbe is one of the most picturesque Italian squares and contains a 10th century fountain, the Casa Mazzanti and the beautiful campanile of the town hall. On the Piazza dei Signori are the former palaces of the Scaliger and other families, as well as the Palazzo del Consiglio and a statue of Dante, who took refuge in Verona for a time. Adjoining the Church of Santa Maria Antica are the tombs of the Scaligers. The cathedral is a Gothic church of the 14th century with a Romanesque facade; the 12th century choir contains an *Assumption* by Titian. San Zeno Maggiore, 11th-14th century, is considered one of the finest Romanesque buildings in northern Italy. The colossal Roman amphitheater, one of the largest in existence, was built under Diocletian and was later known as the abode of the Ostrogothic king, Theodoric. One of the oldest Italian cities, Verona was regarded, after the Lombard domination by the German emperors as the key to upper Italy. The modern city has an art academy, fine schools, a library, museums, and numerous factories. Verona was the birthplace of Catullus and PLINY THE YOUNGER, and also of the celebrated Renaissance artist, PAOLO VERONESE. Pop. 1931, 153,923.

VERONA, a borough of Essex Co., N.J., located 7 mi. northwest of Newark, N.J., and 14 mi. west of New York City. It is served by the Erie Railroad, electric trolleys and motor bus lines. A noteworthy feature is a fine group of community center buildings facing a beautiful wooded park. It is mainly a residential suburb, but has several important industries, the products of which include flags, brushes and bronze powder. Pop. 1920, 3,039; 1930, 7,161.

VERONA, CONGRESS OF, Oct. 20, 1822, one of the European congresses of the Restoration Period held by the Quadruple Alliance to deal with revolutions and the suppression of liberalism. The revolution in Spain and the revolt of the Greeks formed the chief concern of the Powers at the Congress. In 1820 the Spanish had revolted against the reactionary rule of Ferdinand VII, and against the policy of repression in the Latin American Colonies, which had been in a state of revolt ever since the decrees ordering them to return to their pre-war status. For the first time since Napoleon's overthrow, France sided with the reactionary powers of the alliance. Louis XVIII, frightened by the growth of radicalism, had been won over to the reaction by the Ultras, who now demanded intervention against revolution in Spain by a French army under general European mandate. To this the

three eastern powers, Austria, Prussia and Russia, readily agreed. England, where Canning had just come to power, objected to any kind of intervention in the internal affairs of another state and withdrew from the so-called Concert. In accordance with the decision of the four other Powers, however, a French army crossed the Pyrenees in 1823, suppressed the Cortes and restored Ferdinand to power. As a counter move, England and the United States recognized the Latin American Republics and President Monroe proclaimed the Monroe Doctrine.

VERONAL. See BARBITAL; BARBITURIC ACID AND DERIVATIVES; Soporifics.

VERONICA, ST., a pious woman of Jerusalem who gave a towel to Jesus to dry his face on his way to Calvary. An imprint of his face, *vera ikon* or true image, was left on the towel. According to legend she was able to perform miraculous cures with this sacred image. Many legends are associated with her name.

VERONICA, a large genus of herbs, shrubs or rarely trees of the figwort family many of which are commonly called SPEEDWELL. There are some 250 species widely distributed throughout temperate, cold and alpine regions; about 16 native and naturalized species are found in North America. Numerous veronicas, including several shrubby species from New Zealand with handsome flowers, are cultivated as ornamentals; a few possess medicinal properties, and many are widespread as weeds. They bear mostly opposite stem leaves, alternate floral leaves and numerous small flowers in terminal or axillary clusters. Herbaceous garden veronicas have been derived chiefly from a few Old World species. The genus was named for St. Veronica. See also CULVER'S-ROOT.

VERONICA DE JULIANIS, ST. (1660-1727), a Franciscan nun of the Capuchin Order, was born near Urbino in Italy about 1660. She became celebrated because of the visions and heavenly visitations she was said to receive. Veronica died in 1727 and was canonized by Pope Gregory XVI in 1839. Her day is kept on July 9.

VERONICA OF BINASCO, ST. (1445-97), Augustinian nun, was born in Milan, Italy, about 1445. She became an Augustinian nun and spent her life in prayers and saintly austerities. She died Jan. 14, 1497 and was canonized by Pope Benedict XIV in 1747. Her day is Jan. 17.

VERSAILLES, a suburb of Paris and capital of the department of Seine-et-Oise, founded by Louis XIV about the famous chateau which he built as the seat of his court. The enormous Chateau de Versailles, now a national museum, together with the Trianon palaces and the sumptuous gardens designed by Le Nôtre form an imposing spectacle. The city is of outstanding interest because of the important historical events which have taken place within its walls. In 1783 England signed the treaty which acknowledged the independence of the United States; in 1789 the States General of France met here. On

Jan. 18, 1871, the King of Prussia was crowned German Emperor in the Hall of Mirrors. The French Republic was proclaimed here on Feb. 25, 1875, and in this same Hall, on June 28, 1919, Germany signed the treaty which ended the World War. Pop. 1931, 66,859.

VERSAILLES, TREATY OF, the peace pact signed on June 28, 1919, by all the Allied Powers, except China, and by Germany, officially ending the World War. Its provisions went into effect on Jan. 10, 1920, after ratification by the Allies and by Germany. The Versailles Treaty, containing 440 articles and annexes, was extremely severe on Germany, and its territorial, political, military and economic provisions placed a great burden upon the German people. The original document, chiefly drafted at the Conference of Paris, has been many times revised and altered, and certain of its onerous stipulations had been invalidated by tacit agreement or have been repealed by formal decree. Since 1930 the movement for still more drastic revision of the Versailles Treaty has gained considerable ground in Allied nations on both sides of the Atlantic. The Treaty of Versailles consists chiefly of 15 parts.

Part I comprises the Covenant of the League of Nations and defines the obligations of the member nations. Parts II and III deal with the disposition of German border territory in the south, north and east. Part IV gives German colonial possessions to the Allied powers. By the terms of Part V Germany is ordered to destroy such fortifications and war material as will keep her within certain bounds, her army is limited to 100,000 men, her navy restricted to a small coastal flotilla, with no submarines, and the nation is forbidden any military or naval air force. Part VI provides for the return of war prisoners. Part VII demands the delivery of William II for trial—a demand never fulfilled—the trial of other German “war criminals”—a provision later abandoned—and declares Germany and her Allies guilty “for causing all the loss and damage of the war.” The subject of reparations, later much revised, is covered in Part VIII, and Part IX deals with reparations payments. Part X contains a *modus operandi* for the liquidation of German property abroad, and Part XI gives Allied planes the liberty to fly over German territory. Part XII establishes Allied commissions to control traffic on German rivers, canals and harbors, and Part XIII creates the International Labor Office of the League. Part XIV is devoted to such guarantees as the Allied Rhineland occupation and the abrogation of the Brest-Litovsk treaty between Germany and Soviet Russia. Part XV is a general repository for miscellaneous items.

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VERS DE SOCIÉTÉ (“Society Verse”), poetry of an entertaining and polished character which is con-

cerned with light social topics. This form, rarely productive of verse of lasting merit, was common especially during the 17th century, often in the form of encomiums addressed to noble hostesses. In general, the tone is affected and conventional.

VERSE, a succession of words brought together in a single line in such a way that a metrical effect is produced. The life-blood of verse is rhythm which is produced by the regular recurrence of units known as feet. A metrical foot contains one or more syllables in various arrangements, and upon the number and kind of feet included in a verse depends the meter. A syllable, in ancient Greek and Latin poetry, was long or short, according to its quantity, a long syllable requiring twice as much time as a short syllable. In English versification, however, instead of being long or short, a syllable is stressed or unstressed, depending upon the fall of the accent or ictus. The commonest types of feet in English poetry are the dactyl (— — —); one stressed and two unstressed syllables); the anapest (— — —); the iamb (— —); and the trochee (— —). The break in rhythm caused when a word ends within a foot is called the caesura though the word is used also for a break caused by the coincidence of the end of a word with the end of a foot (*diaeresis*). A likeness of vowels produces an effect known as assonance, and a constant or frequent repetition of the same initial letter or sound produces alliteration. Rhyme, a medieval invention, is caused by the likeness of both vowels and consonants at the end of a line. See also POETRY; BLANK VERSE; EPIC; LYRIC; RIME ROYAL; SONNET; VERS LIBRE.

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VERSEZ. See VRSAC.

VERS LIBRE or FREE VERSE, a type of modern poetry which, shaking off all conventional laws of metrical form, rhythm and rhyme, is based chiefly on the new laws that a poem's substance may by its intensity create a new and unique form, and that cadence (roughly defined, the rhythms of the speaking voice) can be more poetically expressive than the old conventional meters. The poetry of WALT WHITMAN was “free,” and certain passages of ancient and modern prose are by their cadence virtually free verse; yet the term is most clearly applicable to a peculiar type of 20th century poetry, such as has been written by Ezra Pound, T. S. Eliot, AMY LOWELL, Conrad Aiken, CARL SANDBURG, Edgar Lee Masters and others.

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VERULAMIUM, a British town in the days of the Roman occupation located near the modern site of ST. ALBANS in Hertfordshire. Before the influx from Rome, the town was probably the home of King Cassivellaunus. The Roman historian Tacitus records the destruction of the town during the revolt of Boadicea in 61 A.D., but Verulamium was rebuilt and rose to importance during the following centuries. Recent archeological excavations on the site of the old town reveal a considerable culture.

VERVAIN, a name given to various species of *Verbena*, especially those with small flowers borne in narrow spikes. They are erect herbs with four-sided stems bearing opposite, toothed, more or less hairy leaves. The European vervain or herb-of-the-cross (*V. officinalis*), a low annual with minute white flowers, is widely naturalized as a weed in North America. The native American vervains include the



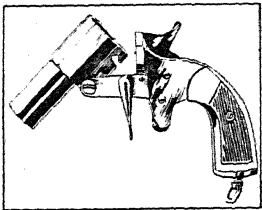
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BLUE VERVAIN
Flower, flowering spikes and leaf

nettle-leaved vervain (*V. urticifolia*), with bluish-white flowers, and the blue vervain (*V. hastata*), with blue flowers, both tall, stiff perennials.

VERVIERS, capital of a district in the Belgian province of Liège on the Vesdre, which divides it into an upper and a lower city. It has a fine church, a city hall, and dyeing plants, tanneries, metal foundries, zinc and lead rolling mills. It produces cashmere, yarn and wool-cards. Pop. 1930, 41,384.

VERY PISTOL, a short, large caliber, breech-loading pistol, usually firing a ten or twelve gauge cartridge of the shot-gun type to project pyrotechnic signals into the air.



VERY PISTOL

VESALIUS, ANDREAS (1514-64), Flemish anatomist, was the outstanding figure in European medicine between the time of Galen and Harvey.

After medical studies at Cologne, Paris, Louvain and Padua, at which latter university he received his doctorate in 1537, he lectured on anatomy at these and other universities. He made anatomy a living, working science, and was noted for his knowledge of the dissected human body. After five years' experience in teaching students to dissect, he published his great work *De Fabrica Humani Corporis* (1543), which was contrary to Galenical tradition. His views brought him much derision and even his old teacher,

Sylvius, failed to support his brilliant pupil. This caused Vesalius to give up anatomy and become court physician to Emperor Charles V and later Philip II. While on a pilgrimage to Jerusalem, he was offered his old chair of anatomy at Padua, but was shipwrecked on the return voyage, and died on the island of Zante in 1564.

M. F.

VESPASIANUS, TITUS FLAVIUS (9-79 A.D.), Roman Emperor, 70-79. After distinguished military service in Germany and Britain, a consulship at Rome, 51, and the governorship of Africa, 63, he was put in charge of Rome's army in Judaea where the Jews had revolted. Shortly after the death of Nero the legions in Syria, Judaea, and Egypt hailed Vespasian as Emperor, 69. The armies of Moesia, Pannonia and Illyricum, espousing his cause, defeated the army of Vitellius at Bedracum, paving the way for Vespasian's accession at Rome. Vespasian devoted himself to restoring discipline in the army and to putting finance and government in order once more. The suppression of a serious revolt in Gaul instigated by CIVILIS, 70, and the capture of Jerusalem, 70, by Titus, the son of Vespasian, brought peace to the Roman world. Vespasian started the construction of the Colosseum. On his death Titus succeeded him as Emperor.

VESPER (Latin *vesper*, eventide), that part of the Catholic BREVIARY sung or recited in the afternoon, usually about four o'clock. It consists of psalms, a Scripture lesson, a hymn with versicle and the Magnificat. "Evensong" was the English name for Vespers, but this now applies to the Evening Prayer of the Anglican Church, which, with Morning Prayer, are condensed and abbreviated forms of the CANONICAL Hours.

VESPUCCI, AMERIGO (1451-1512), Italian merchant and explorer. He became a clerk in the service of the Medici and in that capacity, probably, went to Spain at least as early as 1492. Here he determined to go to the New World, whither, according to his own claims, he made four voyages; the first, in 1497, would by his reckoning have carried him to the Pacific and to British Columbia; the second, in 1499; and the two other voyages, 1501-02 and 1503-04, made in the services of Portugal.

Historians differ widely on the number, time and facts of his voyages. Most writers agree that he did not make a voyage in 1497, but described the facts of his voyage in 1499 under the date of 1497. His second voyage, or first if the 1497 voyage is not accepted, was made with Ojeda, whose expedition left Spain in May 1499, and returned in June 1500. The third (or second), it is generally believed, was made with Diego de Lepe, who sailed from Spain early in 1500 and returned in June 1500. It would, thus, have been impossible for Vespucci to have sailed in both these voyages, unless, as is held by A. Magnaghi in his *Amerigo Vespucci*, he left the expedition of Ojeda and returned alone to Spain before Diego de Lepe sailed. The confusion is still greater since he did not claim to have made but four voyages, and his last voyage, 1503-04,

would be a fifth, if he had made the voyage he claimed to have made in 1497. In spite of the efforts of his biographer, Varnhagen (accepted by Fiske and Thacher), the consensus of opinion of studies made to date has rejected his supposed voyage of 1497, and credits him with secondary positions in the voyages of Ojeda, 1499, Lepe, 1500, and two others in the services of Portugal, 1501 and 1503. In 1505 he returned to Spain and became a citizen, receiving in 1508 the office of chief pilot of Spain.

The fact that America came to bear his name was the result of a misconception, gathered from his own writings and making him appear to have been the first man to touch the mainland. In 1503 he wrote to Lorenzo Piero Francesco di Medici, describing his voyage to the New World. In Sept. 1504, he wrote to Pietro Soderini describing all his voyages. The original is lost, but a Latin translation with the title *Mundus Novus* was published (1505). A French translation was also made and from this a Latin translation that fell into the hands of Martin Waldseemüller, who included it in his *Cosmographiae Introductio* (1507). This gave the impression that Vespucci was the first to discover the New World and his name in the form of "America" gradually supplanted other terms. B. W. D.

VESTA, in Roman mythology, the goddess of the hearth and home, the same as the Greek HESTIA. She was the daughter of CRONUS and RHEA. POSEIDON and APOLLO wooed her; but Vesta was vowed to virginity. AENEAS had brought her sacred fire to Italy together with the PENATES, and it was kept in her temple in the Forum, tended by her priestesses, the vestal virgins. The vestals were at first chosen by the king, but later by the Pontifex Maximus. They had to be over six years old and under 10, with both parents living and free-born citizens residing in Italy. Near the temple of Vesta was the Atrium where dwelt the vestal priestesses, virgins who served for 30 years. The goddess's sacred fire was never allowed to go out. It was renewed each year in March by the rays of the sun or by the friction of dry sticks. The Vestalia, celebrated June 9, was a festival held in Vesta's honor.

VESTAL VIRGINS, priestesses of Vesta, and important religious functionaries in the Roman world. It was their duty to keep the sacred fires burning. A symbol of the hearth, they were the embodiment of purity and chastity. At first they were only four in number but later increased to six. The virgins were selected between the ages of 6 and 10, and were appointed by lot from a list of 20 eligibles selected by the pontifex. They served for a period of 30 years, after which they were allowed to marry if they chose. The first 10 years were spent in learning, the second in performing, and the third in teaching. They had special duties and privileges, but they were also subject to severe punishment for neglect in duty and faithfulness to their vows.

VESTED INTEREST, an enforceable right to something valuable—property, real or personal, tan-

gible or intangible or the carrying out of a contract. The most reliable sanction or agency of enforcement of a vested interest is the law, at least if the law itself is supported by public sentiment. There are other sanctions in tradition, custom, and habit—in a word the established habits of thought, sentiment, and attitudes to which people have been trained and adapted, and which constitute the institutional background of a given legal and economic society. More colloquially, the term vested interests refers to those persons, corporations and institutions which have acquired a place of commanding power and advantage in our economic organization. Thus the great aggregates of capitalistic power represented by the banks and industrial corporations, are, *par excellence*, the vested interests. In certain cases, also, organized labor may acquire something in the nature of a vested interest. Outside the economic field vested interests of greater or less influence may be found in politics, education and the Church. Wherever a vested interest exists its tendency is to maintain the *status quo*, or at least to oppose any change not manifestly to its own advantage. A. B. W.

VESTERÅS, also **VÅSTERÅS**, a city of Sweden, capital of the Vestmanland district, situated on Lake Mälär, 60 mi. northwest of Stockholm. The city is a bishop's see and contains a beautiful 13th-century cathedral and an old castle which is now used by the provincial administration. There are several large factories including the Swedish metal works and the A.S.E.A., a large electrical manufacturing company. Pop. 1931, 30,378.

VESTMENTS, garments prescribed to priests for the observance of religious ceremonies. In the Catholic Church the vestments have changed relatively little since the first thousand years of the Christian era, the Mass vestments of the priest still consisting of the amice, the alb, the cincture, the stole and the maniple, the two latter being in material and color like the chasuble, the chief Mass vestment. The head covering is the biretta. The subdeacon wears no stole, while the deacon wears his, not crossed on the breast like the celebrant, but crossed over the hip. With few exceptions neither deacon nor subdeacon wears a chasuble, but instead a tunic or dalmatic of the same material as the chasuble. The bishop wears, in addition to the vestments of the priest, a tunic and dalmatic of light silk, sandals, buskins, gloves, mitre, pectoral cross and ring, and carries the crozier. An archbishop also wears the pallium. Other vestments include the rochet, surplice, or cotta, adapted from the alb and worn over the cassock or soutane, sometimes with a black cape, also the solemn cope. For certain of the outer vestments worn at divine service liturgical colors are prescribed. See articles under these heads.

VESUVIUS, MOUNT, an active volcano some 4,000 ft. high, rising from the Bay of Naples about 7 mi. east southeast of the city from where its perpetually smoking summit is clearly visible. The modern cone is built up within the "mother crater" of a much older volcano, Monte Somma, of which, in some stupen-

dous prehistoric explosion, the upper half was blown away.

At the opening of the Christian era Vesuvius had been for so many centuries completely quiescent that its capabilities of wholesale destruction were unguessed, even though the Greek geographer, Strabo, had suggested the possible origin of the cone. The first outbreak in historic time was the sudden catastrophic eruption of Aug. 24, A.D. 79, during which the Roman cities of POMPEII, HERCULANEUM, and Stabiae were overwhelmed by rivers of mud and showers of volcanic ash.

Thereafter for 1,500 years the infrequent explosions were of minor importance, though that of 1036 marked the first flow of lava from the mountain. In 1631 the crater was again violently cleared. Since that date Vesuvius has remained in mild activity, punctuated by periodic convulsions when with appalling detonations, steam, rock debris and dust are hurled skyward and lava streams descend the mountain, destroying vineyards, burying villages and taking toll of human life. The more serious of such eruptions occurred in 1779, 1794, 1822, 1872, 1906, and 1929. A cable railway ascends Vesuvius. A national observatory is in operation on the summit.

VETCH, the common name for a numerous genus (*Vicia*) of annual and perennial herbs of the pea family, several of which are cultivated for food, forage and ornament. There are about 150 species widely distributed in temperate regions; 26 species are found in North America. They are mostly climbing plants with pinnate, tendril-bearing leaves composed of one to many pairs of leaflets, small pealike flowers borne singly or in clusters and short, flat pods containing few to many seeds. Among the most valuable cultivated species are the broad BEAN (*V. Faba*), grown for food and forage; bitter vetch or ervil (*V. Ervilia*), narbonne vetch (*V. narbonensis*), spring vetch or tare (*V. sativa*), narrow-leaved vetch (*V. angustifolia*), purple vetch (*V. atropurpurea*), and hairy vetch (*V. villosa*), all natives of the Old World and more or less grown for forage, cover crops and green manuring. Several of the foregoing are cultivated in the Great Lakes region and in the Pacific states. See also BEAN, BROAD.

VETERANS ADMINISTRATION. The Seventy-first Congress of the United States by an act approved July 3, 1930, authorized the consolidation of agencies concerned with the administration of the laws relating to the relief and other benefits provided for former members of the military and naval forces. By executive order of July 21, 1930, the Veterans Administration was established. It is divided into three administrative bureaus, the Bureau of Pensions, the Bureau of National Homes, and the United States Veterans' Bureau, each under the immediate supervision of a director and under the general supervision of the Administrator of Veterans' Affairs. The Administrator of Veterans' Affairs is also a chairman of the Federal Board of Hospitalization, which is advisory to the President on matters relating to the

need for, the location of, and expenditures on account of increased government facilities for veterans' hospitals.

VETERANS' BUREAU, in the United States, a Federal office created to function in the interest of men who have served the country in a military capacity. The functions of the United States Veterans' Bureau are briefly as follows: The adjudication of claims filed for disability compensation; the medical care and treatment of veterans; the maintenance of insurance records of all veterans who have applied for insurance and are maintaining current premiums thereon, and the adjudication of claims resulting from such insurance; the administration of the World War Adjusted Compensation Act. By executive order of July 21, 1930, the United States Veterans' Bureau was consolidated with the Bureau of Pensions, and the Bureau of National Homes. See VETERANS' ADMINISTRATION.

VETERINARY MEDICINE, SCHOOLS OF. Veterinary medicine as taught to-day owes its beginnings to the veterinary school established at Lyons in 1761. This was followed by similar schools elsewhere in Europe and the British Isles. In the United States, the first schools of veterinary medicine were chartered in Philadelphia in 1852, and in Boston in 1855. Subsequently private veterinary schools were established in most of the large cities. In 1868 a chair of veterinary medicine was opened at Cornell University, which later became the first State Veterinary College in America. Other colleges have since organized courses leading to the degree of Doctor of Veterinary Science, and a number of state universities maintain veterinary colleges in connection with their schools of agriculture.

In addition to the school at Cornell, schools of veterinary medicine are maintained at the following institutions: Alabama Polytechnic Institute at Auburn, Colorado Agricultural College at Fort Collins, Iowa State College at Ames, Kansas State Agricultural College at Manhattan, Michigan State College at East Lansing, North Dakota Agricultural College at Fargo, Ohio State University at Columbus, Oklahoma Agricultural and Mechanical College at Stillwater, University of Pennsylvania at Philadelphia, Texas Agricultural and Mechanical College at College Station, University of Vermont at Burlington and State College of Washington at Pullman.

VETERINARY SCIENCE, a science dealing especially with the anatomy, physiology and racial characteristics of domestic animals. It also concerns their breeding and management and their pathology and the treatment of their diseases from both a medical and a surgical standpoint. It may also be said to cover their relations to human beings with regard to communicable diseases and food supply. In common usage, however, the word veterinary generally has to do strictly with animal diseases and their treatment.

Veterinary science is not new, and there is evidence that it was practiced by the ancient Egyptians and

to a lesser extent in Babylonia. Hippocrates investigated the possibility of the communication of animal diseases to man, as did Aristotle, while several other Greek writers left treatises on animal maladies. The twenty-five volume work on veterinary medicine written about 200 B.C. by Mago, a Carthaginian, was quoted by many later writers including the Romans, Varro and Galen. But probably the greatest veterinarian of the Roman Empire was Apsyrus, a Bithynian, of the early 4th century. Apsyrus was the first to describe glanders, farcy and anthrax as contagious and to order isolation in such cases. Many of his surgical treatments are still used in modern veterinary practice.

Veterinary science progressed during the Middle Ages, especially as regards the horse, which played such an important part in the life of the nobles of the period. Still further progress is shown in English books on the horse written in the 17th century. This was especially true in the understanding of anatomy.

Modern veterinary science may be said to have begun with the establishment of veterinary schools in France, the first being founded at Lyons in 1761. A second, founded at Alfort in 1766, is still one of the best of the kind in existence. Similar schools were started soon after in almost every European country, the prime purpose being to train experts for the various armies, especially in France and Germany. The first college of the kind in England was founded in 1792, and the first school in the United States in New York in 1846. To-day there are several private veterinary colleges in the United States and other institutions connected with state agricultural colleges in New York, Ohio, Pennsylvania, Iowa, Washington, Alabama, Kansas and Colorado.

To a much greater extent than is the case with human medicine, veterinary medicine is eclectic—based on practical experience and the deductions that can be made from it. There is much less of abstract theory. Great emphasis is laid on preventive medicine, especially as regards the contagious diseases, which are caused by infecting organisms. Progress in human medicine has brought about progress in veterinary medicine, and the work of such men as Koch, Pasteur and Erlich has meant as much to the latter as to the former. The development of bacteriology has made possible great advances in veterinary surgery, and veterinary surgeons now confidently undertake serious operations.

In the past, veterinary science dealt almost entirely with horses. Human medicine attempts to save life at all costs, but veterinary medicine is guided by the economic value of the animal under treatment. In past centuries, the horse was the only animal of sufficient economic value to justify serious attempts at its cure. Now however the improvement of high grade stock has greatly increased the value of other farm animals, thus directing attention to their maladies, and dogs and cats have been bred for pets until the value of many individuals has reached a very

high figure. The veterinarian of to-day studies all domestic animals, and in the cities are many men who specialize in the treatment of dogs, cats, birds and other pets.

Until recently, the requirements for entrance to veterinary medical colleges were low, and the courses taught at such institutions were by no means complete. Due largely to the efforts of the American Veterinary Medical Association, the standards of veterinary colleges have been raised, and the courses extended to cover three or four years. Membership in the association is possible only to graduates from recognized colleges, and this has raised the social and scientific standards of the profession. The science now includes the pathology of constitutional, functional and infectious ailments, as well as their cure by immunization, inoculation, vaccination, medicine and surgery. It also deals with hygiene, disinfection, feeding and pharmacology, including toxicology. Another modern branch deals with meat and milk inspection, quarantine and traffic in livestock, and the eradication of various animal plagues.

The present high standards are suggested by the courses given in the better institutions. The subjects in the required four years include comparative anatomy, histology, bacteriology, physiology, embryology, pharmacology, toxicology (including both plant and mineral poisons), materia medica, therapeutics, physical diagnosis, vertebrate zoology, parasitology, animal husbandry, theory and practise of veterinary medicine, jurisprudence, ophthalmology, surgery, horse-shoeing, milk inspection, meat inspection, sanitary science, obstetrics, rules of quarantine, serum diagnosis and immunization.

The epizootic diseases of the horse which are of especial interest to veterinarians include glanders or farcy, epizootic lymphangitis, strangles, influenza, dourine and horsepox. The most important diseases of cattle are rinderpest, tuberculosis, black quarter, anthrax, contagious abortion, milk fever, cowpox and foot and mouth disease, while those of sheep include anthrax, rinderpest, black quarter and in addition, sheep-pox and foot-rot. Swine are also subject to anthrax, foot and mouth disease and tuberculosis, and are particularly subject to swine plague and hog cholera, both of which are extremely contagious. Distemper is the most general dog disease, this animal being subject to few other contagious diseases.

Practice of past years relied especially on harsh purges, the firing iron and bleeding. The modern veterinarian does not use as many drugs as did the older men, but gives much more attention to prevention, and to diet and care. It has been found that the severity of almost all diseases can be ameliorated by careful nursing, quiet, pure water and a proper diet. Along lines of prevention, the greatest progress has been in immunization through vaccination and inoculation for such dangerous infectious diseases as anthrax, Texas fever, blackleg, hydrophobia, rinderpest, tetanus and hog cholera.

In such diseases as glanders, dourine, Malta fever,

hemorrhagic septicemia and abortion a method has been developed which makes it possible to make an accurate diagnosis by means of serums. The exact period of incubation of these diseases has been established, and the period of time necessary for quarantine. The importance of isolating the sick animal and of disinfecting its quarters is understood. All these factors have tended to lessen the epizootic diseases.

In the field of surgery, operations are done under proper antiseptic conditions and anesthetics, both local and general, are used. For horses, cattle and larger animals, ether or chloroform is given, while ether alone is generally used for the smaller ones. Successful experiments have been made with ethyl chloride and others of the newer anesthetics. Minor operations are performed successfully under local anesthesia by freezing or cocaine.

Medicines are given by mouth in the form of boluses, balls, pills, capsules and drenches. They are also given by hypodermic and intravenous injections. Veterinary dentistry is usually only a branch of veterinary medicine, although there are a few dental specialists.

Animal industry is greatly in debt to modern veterinary science, since the development of present day inspection methods and of quarantine regulations has made possible the importation of high grade stock for breeding purposes, without bringing in infectious diseases prevalent in other countries. Such inspection and quarantine possibly averted a wholesale destruction of cattle in the United States during a serious epidemic of foot and mouth disease.

Veterinary science also stands on guard against the animal diseases, such as anthrax and glanders, which are communicable to man. It also guards human health through meat and milk inspection. Due to this, such parasites as tapeworm and trichina are now seldom found, and the spread of tuberculosis through infected milk has been greatly limited. The Bureau of Animal Industry of the U.S. Government employs more than a thousand veterinarians for inspection and quarantine work. This Bureau collects data regarding the prevalence, control and eradication of infectious animal diseases, and publishes various reports and treatises containing this information. It is charged with carrying out such measures as are necessary to stamp out epidemics and to prevent the importation of infected livestock. It experiments in the breeding and feeding of various animals and poultry, and prepares and supplies free of charge to proper authorities, sera, antitoxins and other immunizing agents. All of the states have active veterinary staffs engaged in much the same activities. These enforce the various state laws supplementing Federal regulations.

In European countries, veterinarians, connected with the army are army officers, but in the United States these veterinarians are civilians, attached to the various units with which they serve. A. R. F.

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VETIVER (*Vetiveria zizanioides*), a tall perennial grass, called also khus-khus, native to the Old World tropics and naturalized in Louisiana. The plant grows 4 to 8 ft. tall bearing long, stiff leaves and a narrow flowering panicle. It is widely cultivated in warm regions as a hedge plant and for its highly aromatic roots used in medicine, in perfumery and for making screens and mats to scent the air of houses.

VETO, the constitutional power possessed by a chief executive or by the sovereign people to declare null and void or of no effect any law passed by the legislature. The veto power can be absolute or limited. If absolute, the question of the passage of the law is settled for all time. If limited, the veto holds good only for a certain length of time, or the Constitution provides for a method of passing the law over the veto.

VETTER, LAKE. See WETTER.

VEVEY, a city of Switzerland, the second largest city in the canton of Vaud, charmingly situated on Lake Geneva. It has several interesting churches, a castle, a college, a natural history museum in the casino, and many fine private buildings and villas. The city has manufactures of cigars, chocolate, condensed milk, watches and children's food, and trades in wine and cheese. Being a favorite tourist resort it has many hotels and boarding houses. Vevey was a flourishing town in Roman times, but was a fishing village under the Burgundian kings. Pop. 1930, 13,041.

VÉZELAY, a village of northern France famous for its Church of St. Mary Magdalene, which is one of the greatest Romanesque churches in France. This was the church of an abbey founded in the 9th century; but the structure in the main is probably of the 12th century. The narthex, a large and richly carved anteroom, is among the most distinctive features of the church; the choir, built in 1161-75, is in the Gothic style. A fine chapter house adjoins the church. Situated on a dominant hilltop, Vézelay was a place of medieval pilgrimage. Here St. Bernard in 1146 preached the Second Crusade. In 1190 Richard Coeur-de-Lion of England and Philip Augustus of France met at Vézelay to set out on the Third Crusade. Pop. 1931, 585.

VIADUCT, a roadway carried over a valley or gorge, or a mere elevation of a traffic way. In the steel type, a system of towers, carrying TRUSSES or GIRDERS is usual; or there may be a series of steel arches, as in the Riverside Drive Viaduct in New York City. When viaducts are of stone they are usually arched. See also BRIDGES.

VIATICUM (a Latin word, meaning money or provision for a journey), in the Catholic Church the administration of the sacrament of Communion to the dying or those in danger of death. It precedes Extreme Unction, if both sacraments are given at the same time. The words accompanying its administration are, "Receive, brother, the viaticum of Our Lord Jesus Christ, that he may preserve thee from the

malignant enemy and bring thee to everlasting life. Amen."

VIATKA, administrative center and chief trading town of the Viatka district, in the Nizhni-Novgorod region of the R.S.F.S.R., on the Viatka River. This region, the ancient home of the Votyaka, was colonized by Russian merchants in the 12th century. From the 17th to 19th centuries Viatka was the center of heavy trading in oats, flax and lard. With the collapse of Archangel trade its own commerce diminished, but rail links with Moscow and Leningrad led to a revival, the leading articles of commerce being fur, wax and grain. The city is progressing industrially, with a large railway repair shop, leather and hide works and a match factory. Here are located museums, monuments and a number of interesting churches, including the Alexander-Nevsky Cathedral. Pop. 1926, 62,097.

VIBORG. See **VIIPURI**.

VIBRATORY MOTION, to and fro movement in which the excursions of the body carry it back and forth across a point of equilibrium called the *rest point*. The distance from the point of rest to the extreme displacement is called the *amplitude*. There are two kinds of motion, translatory and rotatory. These may be continuous or vibratory. In vibratory motion the FORCE which tends to bring the body to rest at the point of equilibrium behaves as an elastic force, in that the force is proportional to the displacement from the position of equilibrium. Thus, if a strip of steel is clamped at one end and the other is pulled aside, elastic forces in the steel are brought into play and the tendency for the spring to snap back to its position of equilibrium is proportional to the distance the spring is pushed aside. When the spring is bent and then released, it does not return to rest at once, but oscillates back and forth through its position of equilibrium. Such motion is vibratory motion. The prongs of a TUNING FORK execute vibratory motion, as also does a pendulum bob when it swings back and forth through the small arc of a circle.

After a tuning fork is set in vibration, it will gradually decrease the magnitude of its amplitude. This is *damped vibratory motion*. If the prongs of the tuning fork can be maintained in vibration by electrical means, they will vibrate with *simple harmonic motion*. Simple harmonic motion is defined as the projection of uniform circular motion on the diameter of the circle. A steel ball moving with uniform velocity in a circle, has its shadow cast on a wall by a light coming from a direction parallel to the plane of the circle. The shadow will execute simple harmonic motion on the wall. If a tuning fork is made to vibrate in step with another tuning fork, whose period is different from the first, the vibrations are said to be *forced vibrations*.

The time which elapses between the passage of a body through its position of rest until it goes through again in the same direction is called the *period of vibration*. The reciprocal of the period is called the *frequency*.
S. R. W.

VIBURNUM, a numerous genus of handsome woody plants of the honeysuckle family. There are about 120 species native chiefly to north temperate and subtropical regions; 15 are found in North America, mostly in the northeastern United States and adjacent Canada. Several species are cultivated for their showy flowers and attractive foliage. They are usually large shrubs or small trees bearing opposite, undivided, mostly toothed leaves, numerous small flowers in large flat-topped clusters, and ornamental sometimes edible fruits (drupes) with a single, much flattened stone. Among the best known Old World ornamental species are the guelder rose or SNOWBALL (*V. Opulus*), the WAYFARING TREE (*V. Lantana*), the LAURUSTINUS (*V. Tinus*) and the Japanese viburnum (*V. japonicum*). The native North American viburnums include the highbush cranberry (*V. Opulus* var. *americana*), the NANNYBERRY (*V. Lentago*), the hobblebush (*V. alnifolium*), the black haw (*V. prunifolium*), the ARROWWOOD (*V. dentatum*), the witherod (*V. cassinoides*) and the dockmackie (*V. acerifolium*), all of which are more or less cultivated.

VICAR (representative, deputy), one who is authorized to perform functions, particularly of an administrative or religious nature, for another. Vicars of the pope are always cardinals. Vicars of collegiate churches and of cathedral chapters were hired by the canons and prebendaries to take their places when it was their turn to take part in divine service. In the Church of England such vicars remain as beneficed clergy in cathedrals of the Old Foundation, those before the suppression of the monastic chapters, and in the cathedrals of the New Foundation they are paid by the chapters. The title, vicar, is also applied in the English Church to the priest of a parish of which the main revenues are appropriated or impropriated, the priest himself receiving but a stipend, thus being a perpetual CURATE. A capitular vicar is a member of a cathedral chapter elected by the chapter to assume the jurisdictional functions of a diocesan bishop in case of a vacancy. A vicar-apostolic is a titular bishop who represents the pope in missionary territories. A vicar-general, in the Roman Catholic Church, is the regular representative of the BISHOP in all matters of jurisdiction.

An official is an ecclesiastical judge, or a *Vicarius generalis*. A vicar-general need not necessarily possess higher holy orders, but must be a doctor or licentiate of canon law. Although he is the representative of the bishop, he requires a special authorization in each case to exercise a number of the episcopal prerogatives, such as summoning diocesan synods, suspension, excommunication and the like. He presides over the general-vicariate, also called consistory or ordinariate, which is merely an advisory council except when it is sitting as an ecclesiastical court, in which case its votes are decisive. Vicars-forane are rural deans. In the American Episcopal Church a vicar is a clergyman in charge of a chapel belonging to a parish church.

VICAR OF WAKEFIELD, THE, a novel of English family life, by OLIVER GOLDSMITH; published 1766. Written in a clear charming style, this is a leisurely record of the daily life of Dr. Primrose, the lovable eccentric vicar, and his wife, who greatly desires always to be genteel, and of their four children, Olivia, Silvia, George and Moses. It is Olivia's elopement with young Squire Thornhill which almost sinks the family in financial ruin; but the vicar is released from Debtors' Prison and all ends happily when Silvia is married to the wealthy Sir William Thornhill. The most humorous incident is that of the painting of the family portrait. *The Vicar of Wakefield* has outlasted all changes of time and taste by virtue of its clarity, gentle humor and the charm with which it depicts the common things of life.

VICE-ADMIRAL. See ADMIRAL.

VICENTE, GIL (1470-1536), Portuguese dramatist, was born at Lisbon in 1470. Writing in both Spanish and Portuguese, Vicente produced tragedies, comedies, farces and autos, or religious pieces. The *Monologo da Visitacao*, written in Spanish, was the first secular play presented in Portugal, 1502. Vicente has ingenious fancy rather than dramatic power. His lyrics are of exceptional charm. He died at Evora in 1536.

VICENZA, a city of north central Italy, capital of the province of the same name in Venetia, beautifully situated at the base of the volcanic Monte Berico, on both banks of the Bacchiglione. It was the birthplace of ANDREA PALLADIO, 1518-80, the last great architect of the Renaissance, who adorned his native city with superb edifices. The streets are narrow, but there are fine squares with noble monuments and imposing buildings. Noteworthy 13th century Gothic churches are the cathedral, the fine Church of San Lorenzo, the Dominican Church of Santa Corona, and Santo Stefano. They contain paintings by Giovanni Bellini and Palma Vecchio. Among Palladio's works are the so-called Basilica Palladiana, remodeled from a Gothic building in 1549-1614, the Palazzo Prefetizio, 1571, the Teatro Olimpico, completed 1584, the Palazzo Chiericati, perhaps the finest of the master's palaces, and five others of great beauty. The episcopal palace and the Tribunal by Scamozzi are also noteworthy structures worthy of attention. The ancient *Vicentia* existed in the 2nd century A.D. It was the capital of a Lombard duchy and of a Frankish county. In the 12th century it enjoyed municipal freedom. Ruled by the Della Scala family after 1311 and by the Visconti after 1387, the city submitted to Venice in 1404. Vicenza has royal and episcopal colleges, technical, trade, and other schools, an academy of sciences founded in 1550, a library and a municipal museum with rich collections. The chief products are machines, musical instruments, earthenware, macaroni and silk, and there is trade in fruit, wine, grain and cattle. Pop. 1931, 65,177.

VICE-PRESIDENT, UNITED STATES, the second ranking officer in the federal government of the United States. He is the presiding officer in the

Senate and succeeds to the presidency in the event of the president's death or removal from office. The vice-president is elected on a joint ticket with the president and the required qualifications are the same. Until the ratification of the twelfth amendment in 1804, the vice-president and president were selected by one ballot, the largest electoral vote determining the president and the next largest the vice-presidents. Vice-presidents have succeeded to the presidency in six instances, the deaths of Harrison in 1841, Taylor in 1850, Lincoln in 1865, Garfield in 1881, McKinley in 1901 and Harding in 1923.

VICHY, a famous watering place located on the Allier River in south central France. Although known to the Romans, the waters of Vichy attained their enduring renown only after 1676 when MADAME DE SEVIGNÉ introduced them at the court of Louis XIV. Since 1870 the annual number of visitors has increased from about 20,000 to more than 112,000. The season is from May to October. The waters for drinking are exported in great quantities under state control. Pop. 1931, 22,207.

VICKSBURG, a city and port of entry of western Mississippi, and the county seat of Warren Co. It is situated on a bluff 350 ft. above the level of the Mississippi River, at the mouth of the Yazoo River, about 45 mi. west of Jackson. Two railroads, buses, river and ocean steamers provide transportation, and at this point there is a fine railroad and traffic bridge across the Mississippi River. Vicksburg is an important shipping point for cotton and lumber. The manufactures include cottonseed oil products, lumber, furniture, veneer and flooring. In 1929 the factory output was valued approximately at \$5,000,000; the retail trade amounted to \$11,472,065. Vicksburg National Military Park, surrounding the city on the landward side, contains the graves of thousands of soldiers killed in General Grant's campaign to capture the city in 1862 and 1863. The park also contains statues, memorials and other points of historical interest. Vicksburg was incorporated in 1825. It has a modified commission form of government. Pop. 1920, 18,072; 1930, 22,943.

VICKSBURG, SIEGE OF, May 18-July 4, 1863, one of the most important engagements of the CIVIL WAR. The capture of Vicksburg, on a high bluff overlooking the river and strongly fortified, was necessary for the free navigation of the Mississippi by Union vessels. Gen. Grant began his campaign to this end in the autumn of 1862. By May 1863, with an army of 34,000, he had invested the town, confining a Confederate force of 40,000 under Gen. Pemberton. Grant controlled all possible avenues whereby supplies and reinforcements might enter; by July 1 the Confederate force was on the verge of mutiny for want of food. Meanwhile Federal reinforcements nearly doubled Grant's army. On July 4 Gen. Pemberton surrendered the city. The Confederacy thereby lost 30,000 men, who became prisoners of war; an additional 1,000, who perished before the city capitulated.

VICO, GIOVANNI BATTISTA (1668-1744), Italian philosopher and jurist, was born at Naples, June 23, 1668. He was professor of rhetoric at the University of Naples, beginning in 1697, and appointed historiographer to the king of Naples in 1735. His great work, *Principe della Scienza Nuova*, appeared in 1725 and is conceded to have laid the foundations for the philosophic and psychological approaches to history. Influenced by FRANCIS BACON and Hugo Grotius, he traced historical progress from primitive "poetic wisdom" to conscious social legislation. He introduced the famous theory of the "law of cycles" in the history of civilizations. Philosophically he viewed mankind as a unity manifesting itself in its various activities. Vico died at Naples, Jan. 20, 1744.

VICTOR, name of several popes. St. Victor I, 189-198 or 199, was an African. Victor II, 1055-57, was a relative of Emperor Henry III. Blessed Victor III, 1086-87, was elected to succeed Gregory VII, but did not go to Rome. Victor IV was the name of two antipopes, who opposed Innocent II in 1138 and Alexander III in 1159-64.

VICTOR EMMANUEL II (1820-78), King of Sardinia and King of Italy, was born at Turin, Mar. 14, 1820. He was the son of Charles Albert, King of Sardinia, who abdicated in his favor on Mar. 23, 1849. In 1852 he appointed Count Cavour prime minister and, on his advice, he joined France and Great Britain in the Crimean War. In 1858 he endorsed the agreement made by Cavour with Napoleon for an alliance against Austria and in the spring of 1859 undertook, with the aid of France, to drive the Austrians out of Italy. After the victory of Solferino, however, Napoleon secretly came to terms with Francis Joseph. Only Lombardy was free to join Sardinia in 1859. In 1860, however, the work of unification went on through the vote of the people and Victor Emmanuel acquired Tuscany, Parma, Modena, the Romagna, the Marches, Umbria, and with the aid of Garibaldi, the Two Sicilies. In 1861 he proclaimed the Kingdom of Italy assuming the title Victor Emmanuel II, King of Italy. On the other hand, he was obliged to yield Savoy and Nice to France, the former the birthplace of the House of Savoy, the latter of Garibaldi. In 1866 after the Austro-Prussian war, he received Venetia and, in 1870, when the French troops were withdrawing from Rome he occupied it and proclaimed it the capital of United Italy. He died in Rome, Jan. 9, 1878.

VICTOR EMMANUEL III (1869-), King of Italy, was born at Naples, Nov. 11, 1869. He was the son of HUMBERT I and Margherita of Savoy. When only 18 years old, he joined the army, and was active in military affairs. On the assassination of his father in 1900, he became King. During the World War he was commander-in-chief of the Italian Army. His reign has seen three important developments in Italy, first the acquisition of the Trentino and lands along the Dalmatian coast; second the rise of Fascism, and third the reconciliation of the Ital-

ian government with the Catholic Church. The King was married in 1896 to Princess Helena of Montenegro.

VICTORIA (1819-1901), Queen of England, the daughter of Edward, Duke of Kent, fourth son of George III, and Princess Victoria Maria Louisa of Saxe-Coburg-Gotha, widow of the Prince of Leiningen, was born May 24, 1819, at Kensington Palace, London. In Jan., 1820, the Duke of Kent and George III died within a week of each other, and thus, during the reigns of George IV (1820-30) and William IV (1830-37), Victoria was heir to the throne. She was brought up by her mother in strict seclusion, but on the early morning of June 20, 1837, was awakened as Queen. The young girl of 18 years immediately withdrew from her mother's supervision and placed entire confidence in her Prime Minister, Melbourne. On June 28, 1838, she was crowned in Westminster Abbey. Small in stature, plain in feature and with a highly colored complexion, Victoria made no claim to beauty. But her high spirits, combined with a strong will, sensible judgment and formidable dignity, aroused interest and loyalty. In 1839, upon the resignation of Melbourne, she quarreled with PEEL, his Conservative rival, over the right to retain her Whig ladies of the bedchamber, and Melbourne resumed the premiership. On Feb. 10, 1840, she married her first cousin, the handsome Albert of Saxe-Coburg-Gotha, later Prince Consort, to whom she was utterly devoted. They had four sons, of whom the eldest ascended the throne as EDWARD VII, and five daughters. Victoria was thus the grandmother of King George V of England, of ex-emperor William of Germany, the last Czarina, Alix of Russia, the late Crown Princess Margaret of Sweden, Queen Maud of Norway, and the exiled Queen Victoria of Spain. In 1861, the Prince Consort's sudden death left Victoria an inconsolable widow. Victoria was made Empress of India in 1876; she had started her reign as a Whig, but was now an outspoken Tory. Her animus against Gladstone, the Liberal successor to Disraeli, exceeded constitutional propriety, but her prestige was world-wide. Her golden jubilee in 1887, followed ten years later by a diamond jubilee, revealed "the Empire on which the sun never sets." The South African War fell on this glorious reign as a dark cloud in the shadow of which Victoria died, Jan. 22, 1901. At Frogmore, near Windsor Castle, this Queen, second only to Elizabeth, was buried at the Prince Consort's side, as she wished. Her personality has been made clear by the diarist, Greville, by Victoria's own correspondence and by the writings of Lytton Strachey and other modern exponents of the Victorian Era.

VICTORIA, an Australian state occupying the southeastern corner of the continent, with an area of 87,884 sq. mi. It is bounded on the north by New South Wales, on the east by the Pacific, on the south by Bass Strait and on the west by South Australia. The population in 1921 was 1,531,280, which in 1930 was estimated at 1,783,136. More than half the population lives within the metropolitan areas. The

capital is MELBOURNE, and other leading cities are Ballarat, Geelong and Bendigo.

The Great Dividing Range passes through the center of the state, separating it into a northern and southern watershed. The Murray River forms the northern boundary. The southern watershed, sloping to the coast, contains some well-wooded valleys. Bogony, 6,500 ft. in elevation, is the highest mountain.

Agriculture and Livestock. Good soil and a generally sufficient rainfall make about 5,000,000 acres suitable for agriculture. In 1927-28, 3,718,904 acres were planted in wheat, 347,021 in oats and 1,005,063 in hay. Over 6,100,000 acres are used for pastoral purposes. Agricultural production is valued at more than \$40,000,000 yearly and wool at \$45,000,000. In 1929 the state of Victoria had 16,498,222 sheep, 412,977 horses, 1,304,426 cattle and 222,084 pigs.

Mining and Industry. The chief minerals found are coal, gold and gypsum. Gold has been mined since 1851, and though the output is decreasing the fields provided work for 655 men in 1928, when the yield was valued at \$720,000. The staple productions of the state are wool, wheat, flour and butter. Manufactures are mainly for home consumption. The chief oversea exports are wool, wheat and flour, butter, leather, hides and skins, jams and frozen meats. Importations include iron, steel, machines and machinery, metals, silks, textiles, tea and lumber.

Education and Government. Primary education is compulsory, and secondary partly state-controlled. The University of Melbourne has an annual grant from the state. In 1851, Victoria, then known as the Port Phillip district of New South Wales, became a separate colony with a partially elective legislature, and in 1855 self-government was conferred. Parliament consists of a Legislative Council of 34 members, each elected for six years, and a Legislative Assembly of 65 members, elected for three years.

VICTORIA, the capital town and a port of the state of Espirito Santo, Brazil; it is situated on Espirito Santo Island, 260 mi. northeast of Rio de Janeiro. With a lighthouse, piers and warehouses for the coffee trade, the harbor accommodations are excellent. Coffee, sugar, rice and manioc are the principal exports. Pop. 1920, 21,866; est. pop. 1930, 29,243.

VICTORIA, the capital of British Columbia, Canada, situated at the southeastern extremity of Vancouver Island, on the Straits of Juan de Fuca at the entrance to Puget Sound, 81 mi. southwest of Vancouver and 80 mi. northwest of Seattle, Wash. One of the most important ports of Canada, Victoria is strongly fortified. Coal, timber, fish and small fruits of the vicinity are exported and there is a heavy, miscellaneous shipping traffic to the Orient, the United States and Europe. Among the city's many manufacturing enterprises are shipbuilding, fish-canning, lumbering and brewing. Pleasant, well-built and attractive to tourists, Victoria has many fine public works, including the Provincial Parliament buildings,

numerous churches and private schools, a Carnegie library, a museum, Victoria College and University. Tree-bordered boulevards encircle the city, and there are parks totaling 1,600 acres, and a well-equipped airport. Victoria was founded in 1843 by the Hudson's Bay Company and incorporated in 1862. Pop. 1921, 38,727; 1931, 39,082.

VICTORIA, capital and seaport of the British colony of HONG KONG, situated at the foot of Victoria Peak and extending for more than 5 mi. along the seashore. It rises from the waterfront in terraces and presents a very picturesque appearance. Victoria is a great shipping point and possesses one of the finest harbors in the world. Population, including the residential section on Victoria Peak, 1929, 577,500.

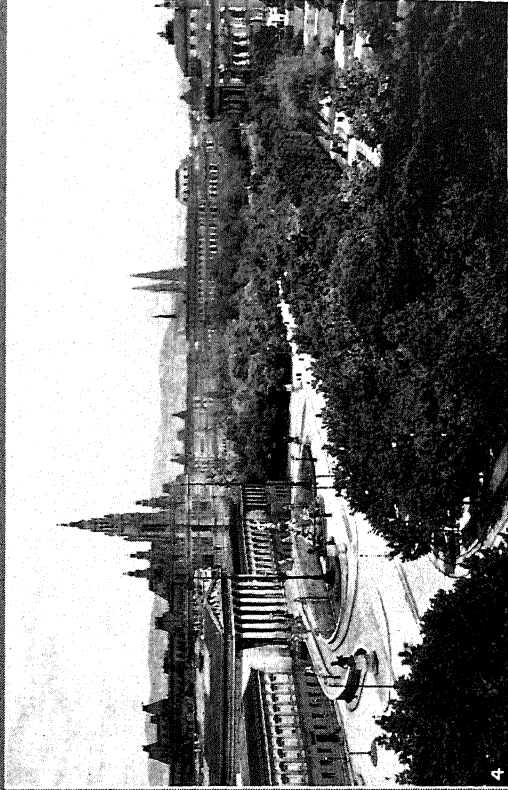
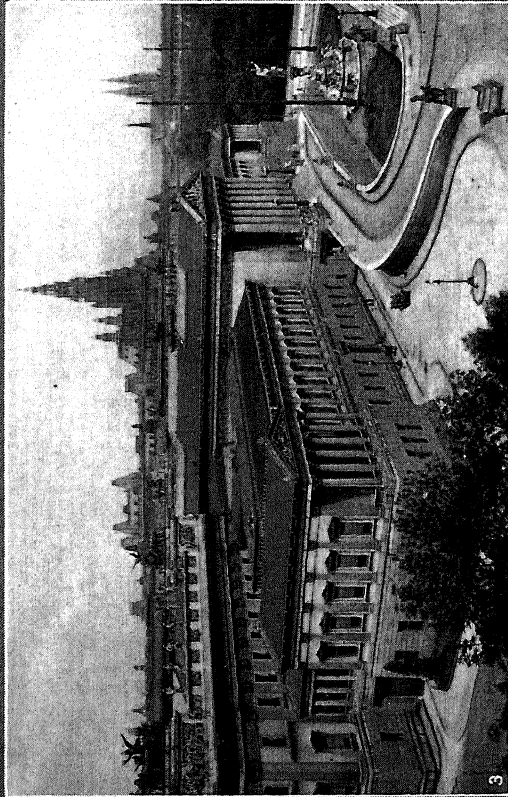
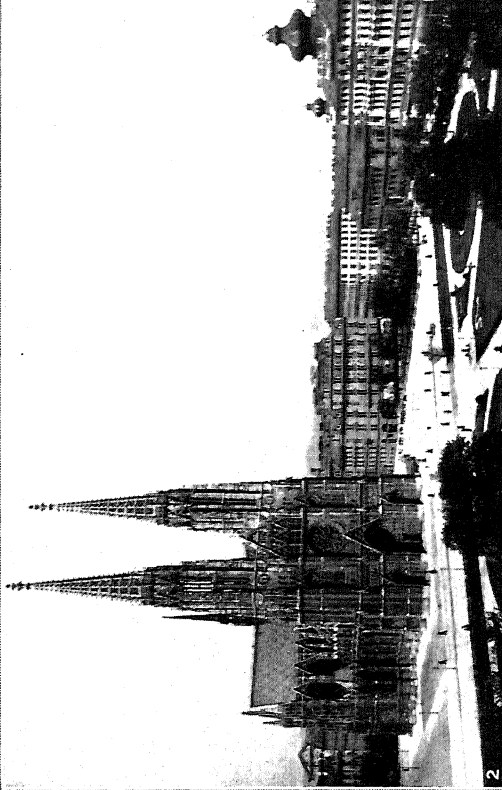
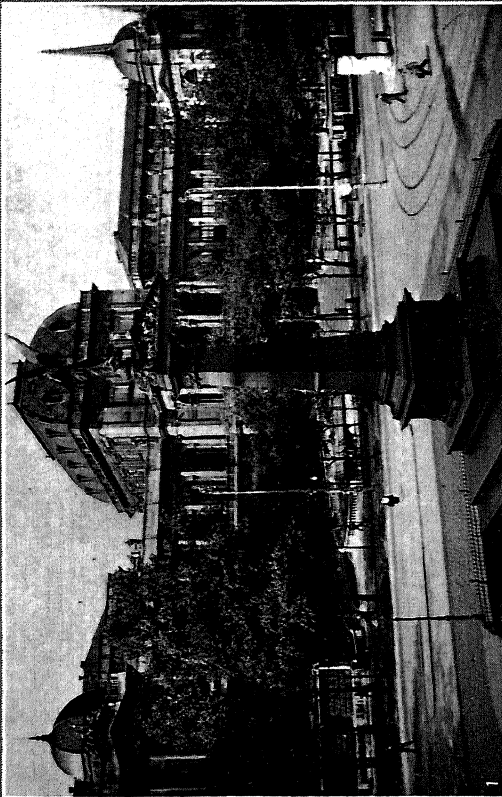
VICTORIA, a city and the county seat of Victoria Co., southeastern Texas, situated on the Guadalupe River, about 128 mi. southwest of Houston. Two railroads and bus lines serve the city, and there is a U.S. government airport. Victoria is a trade center for a fertile region; the chief products are live stock, cotton, grain, poultry and oil. Cottonseed oil manufacture, railroad shop work, the wholesale trade market and three large sand and gravel plants comprise the principal industrial activities. Victoria was founded by the De Leon colony in 1824, incorporated in 1839 and the charter of the present city dates from 1915. Pop. 1920, 5,957; 1930, 7,421.

VICTORIA AND ALBERT MUSEUM, a national institution devoted to the exhibition of works of the decorative and industrial arts, situated at South Kensington, London. The museum was opened in 1857 as the South Kensington Museum. Its aim is to furnish instruction, by means of exhibits, to students and craftsmen interested in architecture and sculpture, ceramics, engraving, illustration and design, book printing, metal work, painting, textiles and woodwork. In conjunction with the exhibits the museum maintains a library consisting of 160,000 volumes on fine and applied arts. The painting section includes the celebrated Raphael cartoons for the tapestries of the Sistine Chapel, and canvases by modern British and French artists. Control is vested in the national Board of Education.

VICTORIA FALLS, a waterfall of the Zambezi River in Rhodesia, South Africa. About midway in its course the Zambezi, here about a mile wide, suddenly jumps 357 ft. in four main cataracts over an outcrop of Tertiary basalt into a narrow crack or fissure which reaches across its bed from bank to bank. This fissure is of an average width of 300 ft., and has one narrow outlet 200 ft. wide by which the enormous volume of water can escape. Immediately after leaving the fissure the river makes a sharp bend. This increases the agitation of the water, causing perpetual volumes of mist to rise, and gives the name of the Boiling Pot to the gorge. The river now begins a tortuous course of some 30 mi. between cliffs 400 ft. high. A bridge with a span of about 650 ft. crosses the gorge a little below the Boiling Pot.

The falls have a horsepower estimated from 300,000

VIENNA

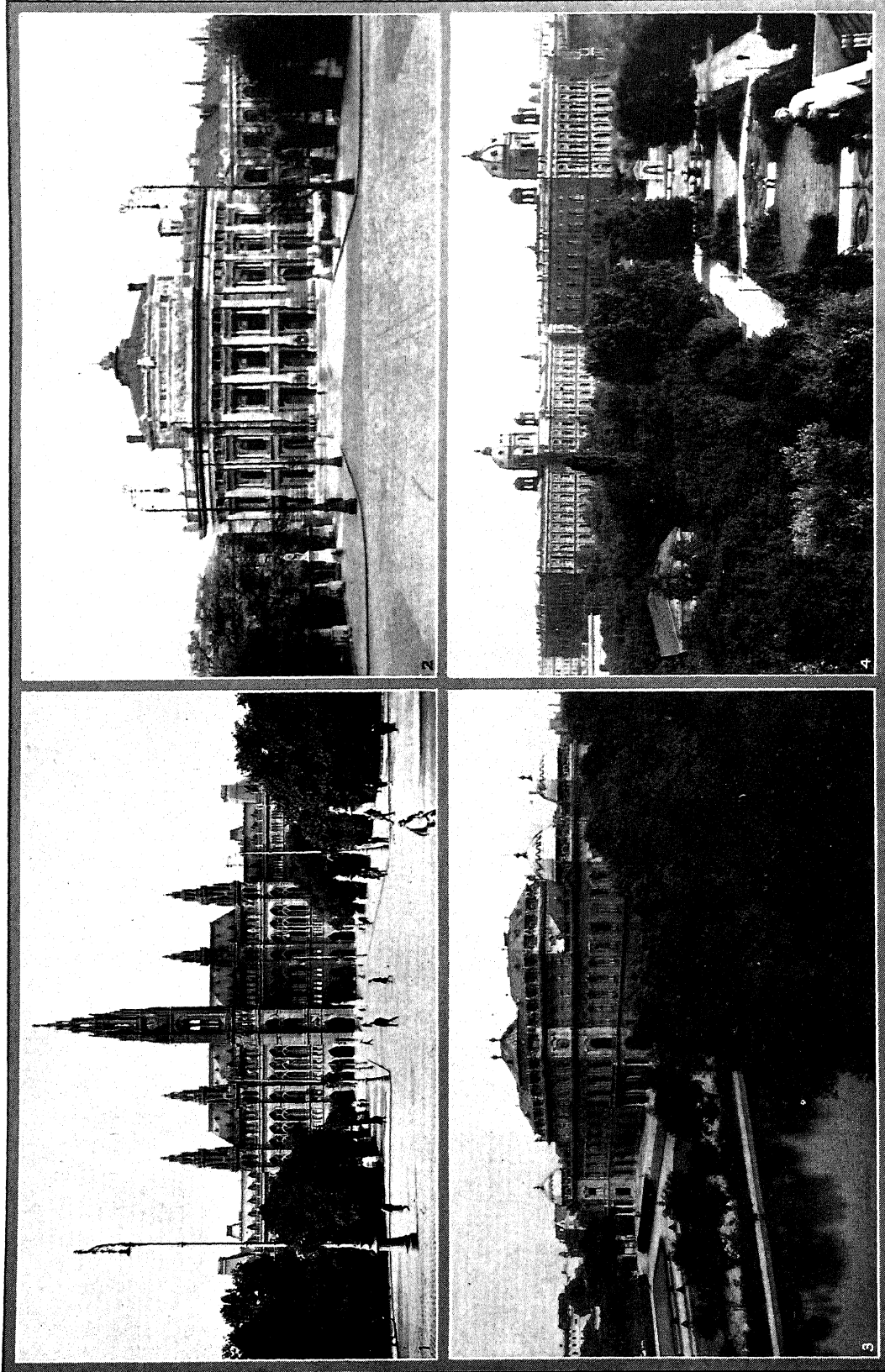


1, 2, 4, COURTESY AUSTRIAN TOURIST OFFICE; 3, CONSULATE GENERAL OF AUSTRIA, NEW YORK

GOVERNMENT AND ECCLESIASTICAL BUILDINGS OF VIENNA

1. The University of Vienna, a building in Renaissance style. 2. Votive Church surmounted by two towers, each 315 ft. high.
3. Parliament Building, its approach surrounding the Pallas Athena Fountain. 4. Ring-Strasse, with the Parliament Building at the left.

VIENNA



PUBLIC BUILDINGS IN BEAUTIFUL VIENNA

1. Rathaus, or City Hall, showing façade in the Gothic style. 2. The "Burgtheater."
3. The Belvedere, imperial summer castle, with the French garden. 4. The Art History and Natural History Museums, two similar buildings.

to 600,000 according to the flow of the Zambezi at different seasons. From the point of view of power supply the Rand-Witbank area and the Natal coalfield have cheap fuel available, and the mining development of the former has led to the creation of a group of stations equipped to supply an enormous amount of electricity and compressed air.

DAVID LIVINGSTONE, who was exploring the Zambezi River towards its source in 1855, discovered the falls and named them after Queen Victoria of England. The neighboring land has been laid out as a public park by the Rhodesian government.

VICTORIA JUBILEE BRIDGE, a steel-truss structure across the St. Lawrence river at Montreal, constructed in 1898-1899 to replace the Robert Stephenson Tubular Bridge. The bridge has 25 spans each 254 ft. long, and one center span of 348 ft., all pin connected. The length of the bridge between terminals is 6,592 ft. and the width 67 ft. The structure, carrying two railroad tracks, two vehicular roadways, two footpaths and double tracks for an electric trolley, rests on the masonry piers of the old Stephenson bridge. The bridge, for which 20,000 tons of steel were required, was constructed over and around the old bridge without traffic interruption. Joseph Hobson was chief engineer.

VICTORIA LAND. See ANTARCTICA.

VICTORIAN BOX (*Pittosporum undulatum*), a handsome evergreen tree of the pittosporum family, native to Australia and widely cultivated as an ornamental. The tree grows 40 ft. high but is commonly pruned as a shrub used for hedges. It bears glossy, entire leaves and exceedingly fragrant, white flowers in small clusters.

VICTORIAN ERA, the period in English literature contemporary with the reign of QUEEN VICTORIA (1837-1901), a period in which the novel predominated. Despite its defects, its lack of candor and excessive reticence, its occasional tendency either to sentimentalize or to moralize, undoubtedly the Victorian era produced some of the finest novels and poems in English. The great novelists of the period include Dickens, Thackeray, George Eliot, the Brontës, Mrs. Gaskell, Kingsley and Lytton; and among the later Victorians, Meredith, Kipling, George Moore and Thomas Hardy. Tennyson and Browning were the outstanding poets, those of lesser note having been A. C. Swinburne, the Rossettis, William Morris, Francis Thompson, Alice Meynell and Matthew Arnold.

Of dramatists, perhaps the most representative were Lytton, author of historical dramas, Dion Boucicault, melodramas, Tom Taylor, Gilbert and Sullivan, comic operas, and Oscar Wilde. Among the writers of fine critical or speculative prose were John Ruskin, Walter Pater, Edmund Gosse, Matthew Arnold and Cardinal Newman. Two major esthetic movements arose in the period, PRE-RAPHAELITISM, and that of the *Yellow Book* "decadence" in the '90's. Lastly, one of the most important monuments of the entire period was Charles Darwin's *On the Origin of*

Species, 1859. See also ENGLISH LITERATURE; ENGLISH DRAMA; separate articles on above authors.

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VICTORIAN STYLE, in architecture, a term applied somewhat loosely to all fashions and tendencies in building and building decorations which were in favor from 1837 until the end of the century, but denoting more strictly the real study of the Gothic past in Queen Victoria's reign. The so-called GOTHIC REVIVAL STYLE lived and died during the years when Victoria was on the throne, and classic styles also had their strong partisans. French and Italian elements were to some extent adopted in English building. Terra cotta, encaustic tiles and colored structural materials generally were much used. Intricacy of detail was popular. The result of all this was a mélange which had in it much that was strange and much that was artificial, and which gave way to later eclecticism. Yet the Victorian era was marked by an honest attention to the structural principles and the careful craftsmanship, as well as the forms, of medieval architecture. England, led largely by John Ruskin, in the middle of the 19th century really sought for the first time to understand, not merely to copy, the masterpieces of the earlier period. It is the work of this honest effort that the term Victorian style most distinctly connotes. For bibliography see MODERN ARCHITECTURE.

VICTORIA NYANZA, the largest lake in Africa, about 400 mi. from the Indian Ocean, and crossed in the northern portion by the Equator. The lake's area of about 27,000 sq. mi. is almost equally divided between Uganda and Tanganyika Territory. It is at a considerably higher elevation (3,800 ft.) than lakes Edward Nyanza and Albert Nyanza, from which it is divided by the Ruanda plateau and the mountainous districts of Toro and Ankole. But its shores are lower and there are numerous excellent harbors on all sides of the lake. The region around Lake Victoria is in many respects the center of Africa, for here the floral and animal types of West Africa meet those of North and East Africa, and the Hamite and the Nilotic Negro mix with the pure Bantu. The outlet of Victoria is a branch of the Nile, which descends the Ripon Falls. Into the lake drain several streams, of which the Kagera, coming from the west, is the largest.

VICTORIA UNIVERSITY, at Toronto, Ont., Canada, a coeducational and non-sectarian institution, originally founded as the Upper Canada Academy in Cobourg in 1836. In 1883 it received the status and name of a university, and in 1892 was affiliated with the University of Toronto and moved to its present location. It had productive funds in 1931 amounting to \$3,141,543. The library of 48,140 volumes contains special collections of Canadian verse and Tennysonian. In 1931-32 there were 1,153 students, and a faculty of 43 headed by the Rev. EDWARD W. WALLACE.

VICUNA (*Lama vicunia*), a South American animal belonging to the camel family. It is related to the GUANACO, but smaller, of more slender build, and lacking the callosities which distinguish the hind limbs of the guanaco. The vicuna inhabits high elevations, being found on the bleak Peruvian mountains almost up to the snow line. It occurs also in Ecuador and as far south as central Bolivia, almost invariably in fair-sized herds. The wool of its coat is highly prized by the natives for weaving, being used in its natural orange-brown color and also when dyed. Attempts to domesticate the vicuna have met with fair success. See also ALPACA.

VIDA, MARCO GIROLAMO (c. 1490-1566), Italian humanist and poet, was born at Cremona, about 1490. After studying theology, he became successively Canon, Prior and Bishop of Alba. His outstanding works are perhaps the *Christiad*, which is significant as the Christian epic of the humanist, and *Ars Poetica*, a didactic poem expounding the humanist position on poetry. To his contemporaries Vida was better known by his Latin poems, the *Silkworm* and the *Game of Chess*. He died at Alba, Sept. 27, 1566.

VIDHARR. See VITHARR.

VIDIN, also **WIDIN**, a Danubian town of Bulgaria, capital of the district of the same name, situated in the extreme northeast, near the border of Yugoslavia. It is connected by a branch line with the Sofia-Lom railway. Vidin is celebrated for its gold and silver filigree, its fisheries, and its cereal, beer and tobacco manufacturing. Pop. 1931, 18,514.

VIEIRA, ANTONIO (1608-97), Portuguese political leader and writer, born in Lisbon, Feb. 6, 1608. In 1614 he came to Brazil and in 1623 he joined the Jesuit order. He went to Espirito Santo to catechize the Indians and learned the Tupi Guarani language and in 1635 he was named Professor of rhetoric at Olinda, then under Dutch rule. He soon became known for his oratorical ability. In 1641 he went to Portugal and was until 1650 one of the most influential political advisers to Joao IV. In 1653 he arrived in Maranhao where he became the defender of the Indians and incurred the wrath of the planters. He was expelled by them in 1661 and subjected to the Inquisition in 1667. Later pardoned, he returned to Bahia, where he died on July 18, 1697. Vieira was one of the most distinguished writers and orators of the 17th century in Brazil and Portugal.

VIENNA (German *Wien*), capital of the Austrian Federated Republic, lies almost entirely on the north bank of the Danube and on the Danube Canal, a canalized branch of the river. Flowing into the Danube River is the little Wien River, arising from the Wiener Wald, the wooded mountains north and west of the city.

Districts and Characteristics. The First District, the Inner City, consists of the Old City and the Ring Street, laid out after the removal of the fortifications in 1857 and built up in the '70s and '80s with monumental edifices, handsome private dwell-

ings, monuments, promenades, parks and gardens. The Ring Street has seven different names, each indicating the section traversed, and ends at two bridges spanning the Danube Canal, along which the Quai Park extends. The limits of the district are beyond the Ring and provide streets parallel to it for commercial traffic. The Inner City is surrounded by a wreath of inner suburbs bounded by the Girdle Street, until 1874 the city limits. The various suburbs beyond grew together and were incorporated, other towns were absorbed and now the greater city includes the foothills of the Wiener Wald. Most of the districts have characteristic features. The Old City contains the medieval landmark, St. Stephen's Cathedral, founded 1144, rebuilt 1300-1510; the former Imperial Hofburg, a group of buildings dating from the 13th century on; three late-medieval churches, splendid Baroque churches, palaces and ministries. The monumental edifices of the Ring include government buildings, museums, Burgtheater, Opera, University and large shops. The adjoining Leopoldstadt, between the Danube Canal and the Danube, is also an important business center. Mariahilf and Neubau contain large factories. In the districts southeast of the Old City are the Technical and Veterinary universities, the Geological Institute, legations, the magnificent Belvedere Palace, with large terraced gardens and lakes, adjoining the Botanical Garden on the east and on the west the Schwarzenberg Palace, 1706. Josefstadt contains chiefly dwellings for officials and in Alsergrund on the north are institutes of the university, hospitals and the palace of Prince Leichtenstein, 1712, with its park. In the outer districts south are factories and workmen's homes, which dominate in the western sections also. Southwest is Schönbrunn, the former residence of the Emperor Francis Joseph, with its gardens. Northeast the settlements are scattered among the hills and near the northwest limits are large vineyards.

Streets and Parks. The chief center of activity is St. Stephen's Square, from which the great arteries of traffic radiate. More than a dozen of the principal squares lie along the Ring and are richly ornamented with sculptured groups, fountains, monuments, statues and columns. There are parks even in the congested parts of the city and monuments throughout. The famous Prater, between the Danube Canal and river, is a fine park provided for the amusement of the people.

Educational Institutions. The university was founded in 1365 and has many institutes and collections. The Technical University, opened 1815, the Agricultural University, the Academy of Fine Arts, 1692, the Theresian Academy, 1754, the Consular Academy and the Academy of Oriental Languages are among more than a thousand schools of various kinds. The Academy of Sciences stands at the head of the many scientific institutes, besides which there is a large number of scientific and artistic societies.

Industry and Trade. Vienna has many branches of industry. The chief products are iron and metal

goods, textiles, garments, food products, building materials, paper, wooden goods and chemicals. Fine leather goods, artistic toys, smoking sets, amber, meerschäum, mother-of-pearl buttons, and women's shoes are some of Vienna's specialties. Its trade, which embraces more than half of Austria's total, consists principally in the importation of food and raw materials and the exportation of finished products. The Danube shipping is heavy and not only imports but also transit business is handled on the Produce Exchange. Since 1921 there have been international sample fairs in May and September. Vienna is the financial center of Austria with its six large- and five medium-sized banks, and several savings banks. It is also an important railroad center with six lines. The local railways are extensive and have 50 stations in the city. The surface car lines were amalgamated 1928. The Danube steamers carried in 1929 nearly 300,000 persons, and 632,476 tourists visited Vienna in that year. There is also a flying field.

History. In Roman times Vindobona was a frontier fortress against Germanic tribes. Emperor MARCUS AURELIUS died there in the year 180. At the end of the 6th century the Avars settled the country. Charles the Great destroyed their realm and founded the Eastern March, which succumbed to the Hungarians in 907. Emperor Otto the Great gained a victory over them in 955 and his son, Otto II, granted the country to Leopold I of the Frankish Babenbergs, whose descendants ruled as dukes after 1156. Henry Jasomirgott, 1141-77, made Vienna his capital. The crusades and the consequent trade with the Orient had a powerful influence on the city's development. Ottocar of Bohemia took possession of the country in 1251. Rudolph of Hapsburg defeated him in 1278 and Vienna became the residence of the Hapsburg dynasty. Despite wars and sieges, the city increased in importance and under the brilliant reigns of Charles VI and Maria Theresa it became the social and political center of the monarchy. Under Francis I—as German Emperor, Francis II, until 1806—Vienna became the capital of the Austrian Empire. Despite internal dissensions the city grew, particularly after the fortifications were removed in 1857, and by 1910 the population had nearly quadrupled since that year. After the World War, the Allies, by threatening to occupy the city, prevented the union of Germany and Austria. Vienna has become the capital of the Austrian Republic. It has suffered greatly from economic and political crises. These have arisen chiefly because of the immense reduction in the area of Austria, leaving Vienna as the capital of a minor state instead of the metropolis of an important empire, with drastic shrinkage in commerce and industry. Since 1919 Vienna has been governed by a Socialist administration. The population is overwhelmingly Teutonic. Bismarck called the city the German capital of a Slavic empire. Est. pop. 1929, 1,842,763.

VIENNA, CONGRESS OF. From Sept., 1814 until June, 1815, a gathering of diplomats representing every European country save Turkey met in the

Austrian Imperial City for the purpose of making the necessary territorial and dynastic readjustments following the downfall of Napoleon. The Congress was a brilliant affair, its sessions being attended by Emperor Francis I of Austria, Tsar Alexander I of Russia, King Frederick William III of Prussia, the kings of Denmark, Bavaria, and Württemberg, Wellington, Stein, Hardenberg, and Humboldt, yet they were only the outstanding figures among a host of luminaries present. The feminine world was represented by such interesting personalities as the Duchess of Sagan, the Grandduchess Catherine, sister of the Tsar, and the "diamond queen" Princess Marie Esterhazy. There were festivities without end, and all in approved 18th century style of formality and pomp.

The Congress was not a regular peace conference in which victors and vanquished haggled over terms. Rather, its sessions provided a meeting-place where the numerous diplomatic representatives and plenipotentiaries might come to agreement on the matters of specific concern to their states. In the end, all the arrangements were collected into a "Final Act of the Congress of Vienna." Two general principles served as the basis for the negotiations: the principle of "legitimacy," that is, the restoration of boundaries and dynasties approximately as these had existed at the outbreak of the revolutionary wars; and the principle of "compensations," that is, the making of compensatory cessions of land to the more important powers whenever it was found impracticable to make exact restitution. Nationalism, on the other hand, was almost entirely disregarded at the Congress. For Metternich considered nationalism to be nothing more than a blind for revolution, a phase of the execrable liberal movement.

Territorial Changes. It was only to be expected that the five big powers—Austria, Prussia, Russia, Great Britain, and France—should dominate the conferences. Naturally these states, too, reaped most of the benefits accruing from the final dispositions. Austria, in compensation for the surrender of distant Belgium to Holland, secured Lombardo-Venetia and the Illyrian provinces along the Adriatic. She also regained the Tyrol and her lost Polish provinces. Members of the Hapsburg family, moreover, were seated upon the thrones of Parma, Modena, and Tuscany in northern Italy.

Prussia gained Hither Pomerania, two-fifths of Saxony, and additional regions along the Rhine, besides recovering Posen and some of the other territories of which Napoleon had deprived her. Russia got back the lion's share of Poland, later known as "Congress Poland," and retained Finland from Sweden and Bessarabia from Turkey. For the loss of Pomerania to Prussia and Finland to Russia, Sweden was compensated with Norway which was taken from Denmark to punish the latter for her persistent loyalty to Napoleon.

England was permitted to retain nearly all the colonial conquests she had made during the revolutionary and Napoleonic periods, securing Cape Col-

ony, Ceylon, and part of Guiana from Holland; Heligoland from Denmark; part of Honduras; the Ionian Islands; and the islands of Malta, Mauritius, St. Lucia, Tobago, and Trinidad. France, dealt with in the second Treaty of Paris, Nov. 20, 1815, was deprived of her imperial conquests but was restored approximately to her size in 1790. She was also required to pay an indemnity of 700,000,000 francs, and to support an army of occupation for five years. The Bourbons were restored in Spain and in the Kingdom of the Two Sicilies, while the Kingdom of Sardinia was permitted to incorporate the former Republic of Genoa. The pope regained his temporal possessions, and the neutrality of Switzerland was guaranteed.

There was of course no earnest attempt to redivide the Germanies into the hundreds of petty states and principalities which had existed prior to 1803. Most of these lands were now simply distributed among the larger states. A suggestion coming from some patriots that the Germanies be united under one strong head was not permitted to gain much hearing, but neither was it seriously contemplated to revive the defunct Holy Roman Empire. Instead, a new Germanic Confederation, consisting of 38 loosely-united states, was organized. Provision was made for a Confederation Diet with representatives selected by the ruling princes, and presided over by Austria. Members of the Confederation were forbidden to enter into alliances directed against that body or against fellow-members. There was, however, no provision for a Confederation flag, army, coinage system, or tariff. Because of the subserviency of the smaller states, the Confederation policies soon came to be dictated from Vienna.

In addition to these territorial settlements, the Congress of Vienna also expressed some pious wishes for general reforms such as the abolition of the slave trade, the opening of international rivers such as the Danube and the Rhine to free navigation, and the regulation of the rights of precedence among diplomatic representatives. Larger problems requiring international action and cooperation there were a-plenty; but the delegates failed to heed them, if, indeed, they saw them.

W. C. L.

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VIENNA, UNIVERSITY OF, at Vienna, Austria, one of the oldest and most distinguished universities in Europe, especially noted for its medical school. It was founded in 1365 by Duke Rudolph IV, and had at first faculties of medicine, law and philosophy, to which Pope Urban VI, in 1384, added a faculty of theology. In 1623, through the influence of Ferdinand II, the university was given into the control of the Jesuits, by whom several of the buildings still in use were erected. The institution fell subsequently into a decline, from which it was succeeded by Maria Theresa (18th century). Under the direction of Gerard van Swieten, the medical school

was given a new basis, upon which it has grown to be one of the outstanding schools in Europe. The university has prospered particularly since 1848-50, when it recovered the academic freedom of which it had been deprived by Joseph II. Of the present university's four faculties, theology, medicine, law and philosophy, that of medicine is by far the most important. Also of importance are the Central Institute of Meteorology, the University Observatory, the botanical garden, and the library containing over 1,065,000 volumes. The quadrangular university building, erected in 1873-84, was designed by Heinrich von Ferstel, in the Italian Renaissance style. The number of students is about 11,000 annually. In 1930 the rector was Prof. Dr. W. Gleispach.

VIERSEN, a German city in Rhenish Prussia about half way between Düsseldorf and the Dutch frontier. It has been a city since 1856. Viersen has an important silk and cotton industry and also produces machinery, paper, leather and furniture. Pop. 1925, 32,169.

VIGÉE-LEBRUN, MARIE-ANNE ELISABETH (1755-1842), French portrait painter, was born at Paris, Apr. 16, 1755. She studied with her father and with Greuze and Vernet. In 1776 she was married to J. B. P. Lebrun, a painter and dealer in works of art. In addition to being famous for her beauty, Madame Lebrun became one of the most fashionable portrait painters of the day, numbering among her sitters Marie Antoinette, Lord Byron and Madame de Staël. She painted more than 600 portraits. Madame Lebrun died at Paris, Mar. 30, 1842.

VIGFUSSON, GUÐBRANDR (1828-89), Icelandic philologist, was born at Breidifjörð, Mar. 13, 1828. He became noted in philology for his studies in Icelandic language and literature. Oxford University conferred upon him an M.A. degree and created a professorship for him. The University of Upsala, Sweden, gave him an honorary doctorate. His most important works are *On the Time Reckoning in the Old Icelandic Sagas* and *Corpus Poeticum Boreale*. He completed Cleasby's Icelandic-English dictionary. Vigfusson died at Oxford, Jan. 31, 1889.

VIGILANCE COMMITTEE, a group of men organized to prevent and punish crime when the local authorities fail. This form of irregular justice is best known in the United States. To some extent, in the days when the sparsely settled portions of that country were harassed by outlaws, vigilance committees did effective service in punishing horse and cattle thieves. In the cities also they occasionally came into being, as in San Francisco, when the chief of police was murdered, they took suspects from jail and shot or hanged them.

VIGILIUS (?-555), Pope, 538?-555. He had been papal legate in Constantinople and in 544 or 545 was ordered by Justinian to return there in order to participate in the negotiations regarding Justinian's *capitula*. After he had condemned the *capitula* in 548, thus greatly antagonizing the bishops of the West, he soon opposed the policy of the Emperor, who then

became very severe with him. He did not take part in the Fifth Ecumenical Council at Constantinople in 553, which condemned the three *capitula*, and saved himself from the results of the imperial disfavor by renouncing his opposition in 553. He died on the journey back to Rome. On account of his vacillating attitude toward Byzantium, a large number of Western bishops refused obedience to Rome.

VIGILS, in the Catholic Church, special services on the days before greater feasts such as Easter, Christmas, Epiphany and Whitsunday, called the greater vigils. There are also many other lesser vigils. All were formerly accompanied by fasting, but at present this holds good only with Whitsunday, the Assumption of the Blessed Virgin, All Saints' and Christmas.

VIGNETTE, a term meaning, literally, "little vine," originally applied to a foliated scroll in Gothic ornament. In book illustration it signified first an illuminated initial embellished with vine tendrils, then an engraved headpiece or tailpiece, whether vine-like or otherwise. By extension it has come to mean any text-cut, not framed in black lines, or any small picture, as the portrait vignette on a banknote.

VIGNOLA, GIACOMO BAROZZI DA (1507-73), Italian architect, was born at Vignola, near Modena, July 7, 1507. He studied at Bologna, Rome, and in France, and after living for a time at Bologna he was called to Rome by Pope Julius II, and after Michelangelo's death in 1564 was commissioned to complete St. Peter's, of which he built the two lateral domes. His other works include the Farnese and Caprarola palaces, at Piacenza and Viterbo, and the Jesuit Church of Jesus in Rome. Vignola's two books, *Regole delle cinque ordini d'architettura*, 1563, and *Regole della prospettiva pratica*, 1583, in which he set forth his theories of the true proportions of perspective and the use of the classical orders were universally translated and had pronounced influence upon later Renaissance and Baroque architects. Vignola died at Rome, July 7, 1573.

VIGNY, ALFRED DE (1797-1863), French poet, was born at Loches, Mar. 27, 1797. For 12 years he was an officer in the army. In 1826 he published *Cinq Mars*, a historical romance, his poems, *Eloa*, *Dolorida* and *Moïse*, having appeared shortly before. In 1835 he published *Servitude et Grandeur Militaires*, a collection of sketches of military life, and in 1837 his collected *Poems*. Vigny's poetry has exerted considerable influence in his own country. He was elected to the French Academy in 1845, and died in Paris, Sept. 17, 1863.

VIGO, a city of northwestern Spain in the province of Pontevedra, situated in a natural amphitheater of the Ria de Vigo. A citadel and fragments of walls remain from former days. The city has a harbor, a hospital for sailors, a broadcasting station, docks, fisheries and machine factories. Vigo is joined by cable with London and, since 1929, with Emden, Germany. Est. pop. 1929, 53,000.

VIIPURI or **VIBORG**, capital of the Finnish province of the same name situated at the mouth of the

Saima Canal, which flows into the Viipuri Bay at the northeastern end of the Gulf of Finland. It has a castle of 1293, educational institutions, a museum and a library and is also the seat of a bishop. The chief manufactures are wooden ware, soap and tobacco products. It is one of the chief export harbors for timber and lumber. Pop. 1930, 56,295.

VIKINGS, the name of the sea-roving members of the Norsemen, or northern peoples. The word is commonly and incorrectly pronounced *Vi-kings*, with the consequence that the Vikings are generally confused with the so-called sea-kings, who were Scandinavian captains of royal blood. The Vikings were scarcely the romantic figures of popular conception, but traders and at times freebooters, despoilers of the shores upon which they descended during the 8th, 9th and 10th centuries in France, England, Sicily and elsewhere. Although in many respects robbers, it may be said in part explanation of their plundering, that the Vikings were chiefly motivated by the scarcity of food in their own inhospitable climes. They were excellent shipbuilders and navigators and courageous and skillful in conflict. See **NORSEMEN**.

VILLA, FRANCISCO ("Pancho") (1872-1923), Mexican bandit and revolutionary, was born of peon parents Dec. 4, 1872 at Las Nieves, Zacatecas. During the Diaz régime he became the leader of a formidable band of cattle rustlers, and was outlawed for murder. In 1910 he joined FRANCISCO MADERO for the sake of immunity, was captured by Gen. VICTORIANO HUERTA but escaped to Texas. It was, however, under VENUSTIANO CARRANZA that he became an international figure. He quarreled with Carranza over Presidential aspirations and military jealousies. He led a campaign against Carranza but was eventually defeated by Gen. ALVARO OBREGON in 1915 and driven to the border. On Jan. 12, 1916 two of his lieutenants perpetrated the Santa Isabel massacre in which 19 American miners on a special train were shot. In March of that same year he led a raid on Columbus, New Mex., when the city was fired upon and 17 American citizens killed. Gen. JOHN J. PERSHING was sent on a punitive expedition to capture Villa. In 11 months and at the expenditure of \$130,000,000, the Americans achieved nothing, for Villa constantly eluded his pursuers. After Obregon became President in 1920 Villa ceased to be a factor in Mexican political or military life, and retired to a ranch given him as a bribe by the Government at La Canutilla in Durango. He was assassinated near Paral in July 1923.

VILLA, a large and elaborate country house complete with its surrounding gardens; especially such an establishment in ancient or modern Italy. In England, and to a less extent in America, the word is sometimes applied colloquially to small suburban houses. Elaborate country houses are frequently shown in Egyptian tomb paintings. These villas usually consisted of a central, lavish and lightly built house with many windows, standing in the middle of a large and formally planted garden area; the

whole was surrounded by a row of minor service buildings, stables, storehouses, etc. A pool was an essential element of the layout.

The ancient Romans had two types of villa, the farmhouse, often of large size and richly decorated, and the gentleman's residence. The latter type was carried to an almost modern degree of comfort and



COURTESY M. M. OF ART

WALL PAINTING FROM A ROMAN VILLA NEAR BOSCOREALE
(1ST CENTURY A.D.)

In this period, house architecture added fluted columns, arabesques, painted walls and marble panels

luxury. The house proper was usually informal and rambling with many long narrow wings to take advantage of wind, sun and views; besides the usual living quarters a complete set of baths was a necessity. Gardens were almost always terraced and aimed at a contrast between formal areas and informal thickets; fountains and running water were everywhere. Extensive remains in Italy, North Africa, Germany and England show how widely spread these establishments were. The best idea of their appear-

ance can be gained from the letters of Pliny the Younger describing his Tusculan and Laurentine villas.

From the narrow formal gardens of the late Gothic castle, the Renaissance architects of Italy developed a type of villa design which is in many ways a resurrection of the ancient Roman ideal. The house architecture is, of course, different; but the garden layouts, the terracing, the abundance of pools, fountains and running water, the contrasts of formal and informal, and above all the close relation of building and garden, these are all akin to the ancient Roman plans. The great period of Italian villa design was the second half of the 16th century; but great designs were carried out for another hundred years. The greatest examples are the villa Lante at Bagnaia, about 1550, by Vignola; the villa D'Este at Tivoli, 1549, by Ligorio; the villas Falconieri and Mondragone at Frascati, 1546 and 1575; and, in or near Rome, the Albani, the Borghese, and the Doria Pamphili, all of the 17th century. These Italian Renaissance villas exerted an enormous influence on garden design throughout Europe; but never in France, England, or Germany was there achieved the perfect integration of architecture and nature into one composition which is the chief characteristic of Italian villa design, and the reason for their unique beauty. T. F. H.

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VILLACH, the second largest city in the Austrian province of Carinthia, situated on the Drau River. It is a busy industrial town and a center of the lumber trade. Henry II presented Villach to the newly formed bishopric of Bamberg at the beginning of the 11th century and it was sold to Austria in about 1760. Maximilian I gained a victory over the Turks at Villach in the last decade of the 15th century. Pop. 1923, 20,070.

VILLAFRANCA, PEACE PRELIMINARIES

OF, July 11, 1859. The peace negotiations at Villafranca between Napoleon III and Francis Joseph followed the days after the Battle of Solferino in the Italo-Austrian War of 1859 in which Napoleon as the ally of Sardinia had joined the Italians in a war to expel Austria from north Italy. Fearful of defeat, despite the victory at Solferino, Napoleon secretly opened negotiations with the enemy, and reached an agreement at Villafranca. It declared that the two sovereigns favored the creation of an Italian Confederation under the honorary presidency of the Pope; provided for the cession of Lombardy to Napoleon, who in turn was to surrender it to Sardinia; provided that Venetia remain under Austria but become a member of the Confederation; that the Dukes of Tuscany and Modena return to their states; that the Holy Father be asked to make "certain indispensable reforms," and that "full and complete amnesty" be granted to all persons compromised in the recent war. Despite Cavour's indignation at what he re-

garded as an unpardonable betrayal of the alliance, the terms were later incorporated in the definitive Treaty of Zurich.

VILLANELLE, a verse-form derived from the Italian *villanella*, a song sung in the countryside, generally without music. Used irregularly by Du Bellay and other 16th century poets, the villanelle was definitely fixed in form by Jean Passerat, a late 16th century writer. It consists of five tercets and a final quatrain on two rhymes, arranged so that the first and third lines each appear four times (Aba abA aba abA aba abAa). In the 19th century the form was revived and adroitly used by English poets.

VILLANI, GIOVANNI (c. 1275-1348), Florentine merchant and historian. After some years of travel in Italy, France, and the Low Countries, Villani returned to enter public life in his native city. He was prior in 1316, becoming officer of the mint the following year. In 1321 he superintended the rebuilding of the city walls. When Florence was visited by famine in 1328 Villani was active in relief work. At one time he was held as a hostage by Ferrara. He was involved in the bankruptcy of the firm of Bonaccorsi and served a term in prison. A visit to Rome so inspired him with the greatness of that city that he determined to write the history of his own city, covering the period from the Tower of Babel to 1346. His active public career gave him an excellent insight into the constitution, arts, and economic life of the city, which he depicts vividly. Although a Guelph in politics, he wrote without marked bias. His chronicle, which was continued by his brother Matteo and his nephew Filippo, is an important source for early Florentine history. Villani died of the plague in 1348.

VILLANOVA COLLEGE, at Villanova, Pa., a coeducational institution conducted by the Augustinian Fathers. It is an outgrowth of the monastery established in 1842, and comprises schools of Arts, Philosophy, Letters, Science, Technology, Commerce and Finance, besides Preparatory, Extension and Summer schools. The college had an endowment fund in 1931 of \$3,000,000. In 1930-31 the faculty numbered 76, headed by Pres. James Griffin, and the student body, 1,000.

VILLA PARK, a village in Du Page Co., north-eastern Illinois, situated 15 mi. west of Chicago and served by four railroads. Farming is the chief interest of the vicinity. The city is mostly residential, although a malt tonic is manufactured. Pop. 1920, 854; 1930, 6,220.

VILLARD, HENRY (1835-1900), American journalist and financier, born at Speyer, Bavaria, Apr. 10, 1835. In 1853, he came to the United States and entered journalistic work. During the Civil War, he traveled as correspondent with the Army of the Potomac, and the New York *Tribune* sent him to Europe in 1866 to report the Austro-Prussian War. On his return he undertook to represent German bondholders in Northwest railroad negotiations, and by consolidating railroad properties he formed the Northern

Pacific, of which he was elected president. Financial difficulties forced him to resign, but after winning back his fortune he became a director of the road. In 1890, he organized the Edison General Electric Co., of which he was president two years. In 1881, he bought control of the New York *Evening Post* and the *Nation*. He died at Dobbs Ferry, N.Y., Nov. 12, 1900.

VILLARD, OSWALD GARRISON (1872-), American journalist and editor, was born in Wiesbaden, Germany, Mar. 13, 1872, the grandson of WILLIAM LLOYD GARRISON, the Abolitionist. He was educated at Harvard, and from 1894-96 was assistant professor of United States History at that university. In 1897 he became connected with the New York *Evening Post* on which he served as both proprietor and editorial writer until 1918, when he sold the *Post* and devoted himself to the *Nation*. Among Villard's works are *Germany Embattled*, 1915, and *Press To-day*, 1930.

VILLARD DE HONNECOURT, medieval architect, the details of whose life, except that he lived in France in the 13th century, are not known. One of his notebooks, however, has survived and is one of the best sources of insight into the methods and detailed procedure of the medieval architects and builders. The notebook is preserved in the National Library at Paris. A replica was published by Lassus and Darcel in 1858.

VILLARI, PASQUALE (1827-1917), Italian historian and statesman, was born in Naples, Oct. 3, 1827. Expelled from Naples after the Revolution of 1848 he went to Florence where he became professor of history. In Italian literature, he holds an enviable position because of his critical work in biography and history: *Savonarola*, 1888; *Machiavelli*, 1895; *Florentine History*, 1894; *Barbarian Invasions of Italy*, 1902, are his outstanding books. Besides his professional work Villari served successively as Deputy, 1867, Senator, 1882, and Minister of Education, 1891-92. He died at Florence, Dec. 7, 1917.

VILLARICA, or **VILLA RICA**, a city of Paraguay in the department of Villa Rica, 93 mi. southeast of Asunción with which it is connected by the Paraguay Central Railroad. It is the largest interior town of the republic, and lies in the center of a rich agricultural district. *Yerba maté*, tobacco, maize and sugar cane are produced, and the industrial plants of the town are brick and tile works, sawmills, distilleries and sugar refineries. Villa Rica was founded in 1566. Est. pop. 1926, 32,000.

VILLARREAL, a city of Spain, in the province of Castellon de la Plana. It is located in a fruitful plain watered by the Mijares about 4 mi. from the Mediterranean. The city has remains of the old fortifications which give it a Moorish aspect, the 16th century San Pascual Church and the Archpriest's Church, built from 1752 to 1779. Villarreal grows oranges and makes brandy and wine. Est. pop. 1929, 18,000.

VILLEHARDOUIN, GEOFFROY DE (c. 1150-c. 1214), French historian, was born about 1150

probably in Champagne. He was marshal of Champagne and one of the prominent figures in the Fourth Crusade. (See CRUSADES.) Villehardouin is chiefly notable as the author of the *Conquête de Constantinople*. This was written after 1207 and is our chief source for this crusade. He was one of those who carried on negotiations for shipping with the Venetians, and throughout the expedition he participated in the councils of the leaders. By omission rather than assertion his account tends to justify the course which the crusade took, much to the scandal of western Christendom. After the capture of Constantinople he took part in the campaigns of the Emperors Baldwin and Henry against the Bulgarians, received a Balkan fief and was appointed marshal of Roumania. There is scarcely any information about him apart from his own book which is not only important as an historical source but is one of the outstanding works of medieval literature, being the first place of historical prose in French. In it we find not only a picturesque and vivid account of a series of important and dramatic events, but also an unconscious and spontaneous revelation of the feudal point of view at an epoch when feudalism and chivalry had not yet become decadent. Villehardouin died about 1214.

R. A. N.

VILLENA, ENRIQUE DE (1384-c. 1434), Spanish writer, was born in 1384. His work is of a startling variety, including a treatise on the *Art of Poetry*, 1414, an epicure's *Guide to Carving*, 1423, a dissertation on the Evil Eye and a treatise on leprosy. He prided himself on being the first translator of the *AENEID*. During his lifetime Villena was deemed a wizard because of his versatility and sympathy with new ideas. He died about 1434.

VILLIERS DE L'ISLE ADAM, PHILIPPE AUGUSTE MATTHIAS, COMTE DE (1840-89), French symbolist poet and writer, was born at Saint-Brieuc, Nov. 7, 1840, of a family ruined by the French Revolution. A passionate admiration for Poe, Hegel and Wagner is reflected in his writings. *Isis*, 1862, a somewhat occult work, had but a moderate success. Villiers wrote constantly, but only after 1870 was his talent recognized. *Contes cruels*, 1883, brought him real fame, increased by *L'amour suprême*, a philosophic novel published in 1886, and *Nouveaux contes cruels*, 1888. Villiers died in Paris, Aug. 18, 1889.

VILLON, FRANÇOIS (1431-c. 1463), French poet, was born probably in Paris in 1431, of poor parentage. From first to last his life was a succession of fights, brawls, imprisonments and banishments. He was a vagabond and a thief, but he remains one of the greatest poets France has produced. His chief work is his *Grand Testament*, which contains the famous and exquisitely beautiful *Ballade des Dames du Temps Jadis*, with its haunting question known in English as "Where are the snows of yesteryear?" The influence of Villon on French poetry has been very great, and as a master of the BALLAD he has had few equals. The last mention of the poet in

history is Jan. 5, 1463, and it is presumed that he died during that year. See also FRENCH LITERATURE.

VILNA or WILNO, the cultural, political and economic center of northeastern Poland, is distinguished by its beautiful situation on a number of partly afforested hills, through which winds the River Wilja. The 35 beautiful church towers, restored after a devastating fire in the middle of the 18th century, warrant the attention of visitors. The Vilna cathedral, rebuilt in the classic style at the end of the 18th century, and the fine Baroque chapel of St. Casimir are well worthy of a visit. Nearby, on the hill, are the ruins of the royal castle, and on the market place there is a building of the University, which was founded in 1578 by King Stefan Batory and reopened in 1920. The most beautiful building in Vilna is the Baroque church of St. Peter and Paul in the Antocal quarter, adorned inside with 16th century Italian ornamentation. The principal industries are manufactures of metal, leather, woolen and other goods, and trade in grain and lumber. So-called Northern Fairs are held annually. Vilna has been the seat of a Roman Catholic archbishop since 1925, and of a Greek Orthodox Bishop and Protestant general superintendent. It is the capital of the voievodship of the same name. Est. pop. 1930, 201,925.

VIMY RIDGE, BATTLE OF, a part of the three-fold Franco-British offensive in 1915 during the WORLD WAR. Vimy Ridge, three miles south of Lens, in northern France, commands a wide stretch of country, and on Sept. 25, 1915 the French launched their attack, simultaneous with the British attack 20 miles north at Loos. After three days' fighting the French Tenth Army reached the top of Vimy Ridge, but did not dislodge the Germans.

VIÑA DEL MAR, sometimes called the most beautiful city of Chile, a 50-minute ride by electric car from Valparaiso. It is the chief summer resort for the republic and is made up of fine homes with lovely gardens, tennis courts, golf courses, clubs and race tracks. The large Casino was opened in 1930 by Edward, Prince of Wales. The houses are of French architecture, and the whole aspect of the resort is European. The summer residential palace of the president of Chile is located here. Viña del Mar has a delightful climate. Pop. 1930, 49,488.

VINCENNES, a suburb of Paris known for its park and 14th century chateau. St. Louis is said to have administered justice under an oak tree here. Louis XI made the castle a prison; under Napoleon it became an arsenal and to-day it is a fort. The historic Bois de Vincennes contains industrial and natural history museums, also the largest race course near Paris, as well as a field for military manoeuvres. The Pershing stadium, given by the United States to the city of Paris, is situated here. Pop. 1931, 46,859.

VINCENNES, the oldest permanent settlement of Indiana, a city and the county seat of Knox Co., on the Wabash River, about 50 mi. north of Evansville. Intersected by Federal highways and served by river

steamboats, four railroads and a municipal airport, it is the market for the surrounding grain and fruit-growing region which also has extensive coal mines, and gas and oil wells. Vincennes has numerous industries. In 1929 the manufactures reached approximately \$7,000,000; the retail trade amounted to \$9,891,180. There are Indian mounds in the vicinity which was formerly inhabited by the Piankashaw tribe. The Indians were friendly to the French immigrants from Canada who established a trading-post in 1702 on the site of their village, Chippe Kokee, and called it Au-Post. The present name was derived from that of a French commandant who erected the fort, about 1731, which the British occupied in 1777 and renamed Ft. Sackville. It passed into American control, Feb., 1779, through George Rogers Clark's expedition. Historic buildings, dating from the period 1800-13, when Vincennes was the capital of Indiana Territory, include Vincennes University (1806), and a Catholic cathedral erected in 1835 on the site of a still older (18th-century) church. The city was chartered in 1856. Pop. 1920, 17,160; 1930, 17,564.

VINCENT, ST., Spanish deacon and martyr, was born in Spain during the persecutions of Diocletian in the 4th century. He was born of noble family, received a good education, and was ordained deacon. Refusing to renounce his faith even under torture, he was martyred about 304. Some famous hymns were composed in his honor by the Spanish Christian poet Aurelius Prudentius. St. Vincent's day is observed on Jan. 22.

VINCENT, GEORGE EDGAR (1864-), American educator, was born at Rockford, Ill., Mar. 21, 1864. He was graduated from Yale in 1885, and joined the Chautauqua System the following year, serving first as literary editor of the Chautauqua Press, and later as vice-president, principal of instruction, and president. He became honorary president in 1915. From 1892-1911, Vincent was a member of the faculty of the University of Chicago, where he was dean of the Junior Colleges, 1900-07; professor, 1904-11; and dean of the faculties of arts, literature and science, 1907-11. He became president of the University of Minnesota in 1911, and resigned in 1917 to take the presidency of the Rockefeller Foundation, New York. He retired from that office in 1929. Vincent is author of *Social Mind and Education*, and, with A. W. Small, *An Introduction to the Study of Sociology*.

VINCENT, JOHN HEYL (1832-1920), American Methodist bishop and one of the founders of the Chautauqua movement, was born at Tuscaloosa, Ala., Feb. 22, 1832. He began preaching at 18 years of age, and in 1852 was working with the Newark (N.J.) City Mission. He subsequently held pastorates in various parts of the country. In 1865 he established the *Sunday School Quarterly*, and a year later, the *Sunday School Teacher*. Vincent became corresponding secretary of the Sunday School Union, editing many Sunday school publications, including the

Sunday School Journal, the circulation of which he raised to 100,000 copies. In 1874 he helped found the Chautauqua Assembly, and four years later founded the Chautauqua Literary and Scientific Circle, of which he was chancellor the rest of his life. He was made bishop in charge of European work in 1900, but retired in 1904. Among Vincent's writings were many educational works and the *Chautauqua Movement*. He died at Chicago, Ill., May 9, 1920.

VINCENT DE PAUL, ST. (1576-1660), French ecclesiastic and founder of the Lazarites, was born at Pouy near Dax in Gasconne, Apr. 24, 1576. His parents were poor, but he received a good education at Toulouse under the Franciscans and at the age of 24 was ordained a priest. Captured by Barbary pirates, he converted his captors, and after several years of missionary work returned to France where he showed his organizing genius by founding the Congregation of Lazarist Missionaries and the famous organization known as the Sisters of Charity. He was also eminently successful in arousing the peasant masses to a realization of their spiritual needs and his name is associated with many other benevolent organizations that he helped to form. Vincent de Paul died in Paris, Sept. 27, 1660, and was canonized by Pope Clement XII in 1737. His feast day is kept on July 19.

VINCENTIANS, in most English-speaking countries the name for members of the Congregation of the Mission of St. Vincent de Paul; elsewhere Lazarists, from the Priory of St. Lazare, the former mother-house in Paris, but in Spanish-speaking countries "Paules." In 1625 the Congregation was officially established in Paris by St. Vincent for the purpose of ministering to the spiritual needs of the rural population, which had then little contact with the clergy. The Congregation flourished and had about 150 establishments in France, the Palatinate, Spain and Portugal. It also had foreign missions on the Barbary coast, in Madagascar and in China at the outbreak of the Revolution, which swept away all 78 of the French houses. A period of reorganization and expansion restored a normal condition by 1827. There are now 240 houses of the Congregation and upward of 4,100 members distributed throughout the world. Somewhat less than two-thirds of these are priests. The Vincentians take simple vows but are not a religious order; seminaries take the place of novitiates, and the missionaries dress as secular ecclesiastics.

VINCENT OF LÉRINS, ST. (5th century), Church controversialist, was born of a noble family in Gaul during the 5th century. Although destined for the army, he espoused a religious life and retired as a hermit to the Island of Lérins off the Mediterranean coast of France. Here he became a monk and was ordained priest. His keen intelligence prompted him to engage actively in the theological controversies of the day, and the most famous work resulting from these discussions was the *Commonitorium*, 434, which is still cited for the relevance of its doctrines and cogency of its arguments. St. Vincent is the alleged

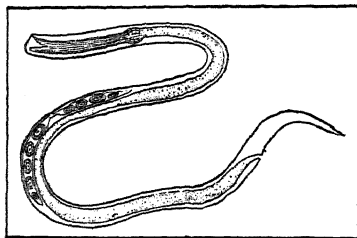
author of the celebrated maxim of orthodoxy: *quod ubique, quod semper, quod omnibus creditum est*, "that which is believed everywhere, always, and by everybody." His philosophical position is that of moderate Augustinianism. The saint died about 450, probably at Lérins. His feast day is observed on May 24.

VINCENT'S ANGINA. See MOUTH, DISEASES OF; TONSILLITIS.

VINCI, LEONARDO DA. See LEONARDO DA VINCI.

VINE, any woody or herbaceous plant the stem of which requires support, especially a plant which climbs by encircling movements of its stem or by means of tendrils or other modifications of its structure. The name is applied also to prostrate or creeping plants, as the watermelon, and sometimes to plants which spread by long runners, as the strawberry. In British countries the term vine is usually applied only to woody plants of the grape genus (*Vitis*), and especially to the Old World grape (*V. vinifera*), the vine of history. See CLIMBING PLANTS.

VINEGAR EEL, the common name for a species (*Anguillula aceti*) of eel-worm (*Anguillulidae*),



VINEGAR EEL OR EEL-WORM
Anguillula aceti

about $\frac{1}{16}$ inch long, which is often found living in old vinegar that has been exposed to the air. See also EEL-WORM.

VINEGARS, result from the alcoholic and subsequent acetous fermentations of apple juice, grape juice, or an infusion of barley malt or cereals whose STARCH has been converted to sugar by malt. They are named according to the raw material from which they are made. Sugar vinegar and glucose vinegar are manufactured by the fermentation of solutions of SUGAR and GLUCOSE, respectively. YEASTS of the saccharomyces group transform the sugar present in the fruit juice or the mash to alcohol, which is oxidized to acetic acid by bacteria of the acetobacter group in the vinegar generator. Spirit or distilled vinegar is obtained by the oxidation of diluted alcohol by the same organisms. All vinegar must contain not less than four grams of acetic acid in one hundred cubic centimeters (20° C.) of the liquid. Vinegar is used chiefly in the home as a condiment and also as an ingredient in the commercial manufacture of certain pickles.

H. T. H.; O. E. M.

VINELAND, a borough of Cumberland Co., N.J., located 34 mi. south of Camden and 35 mi. northwest

of Atlantic City. It is served by the Pennsylvania and Central of New Jersey railroads, electric trolleys and motor bus lines. It is the trading center of a prosperous truck-gardening and fruit-growing area and is an important poultry center as well, and Vineland has a number of important industries, the products of which include clothing, hard rubber goods, thread and glassware. Pop. 1920, 6,432; 1930, 7,556.

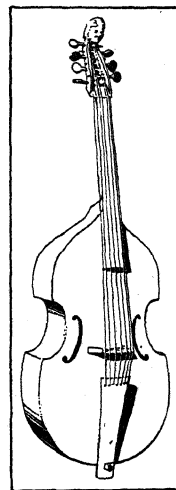
VINITA, a city in northeastern Oklahoma, the county seat of Craig Co., situated 65 mi. northeast of Tulsa. It is served by the Frisco and the Missouri, Kansas and Texas railroads. The city ships the products of the vicinity: fruit, grain, hay, livestock and milk. Food canning and butter manufacture are the local industries. Vinita was incorporated in 1898. Pop. 1920, 5,010; 1930, 4,263.

VINNITSA, a large town in the western portion of the Ukrainian S.S.R., a railway center and until 1925 the capital of the now non-existent Podolia Province. The city, which lies in a productive farming country, numbers beet sugar refineries and flour mills among its industries. It possesses a valuable museum. Pop. 1926, 57,990.

VINSON, ROBERT ERNEST (1876-), American educator, was born in White Oak, S.C., Nov. 4, 1876. He was educated at Austin College, Union Theological Seminary, Va., and the University of Chicago. In 1899 he entered the Presbyterian ministry as pastor of the First Church at Charleston, W. Va., where he remained until 1902 when he became a professor at the Austin Theological Seminary, Texas. Vinson served as president of the latter from 1908-16, and of the University of Texas from 1916-23, and in 1923 was elected president of Western Reserve University.

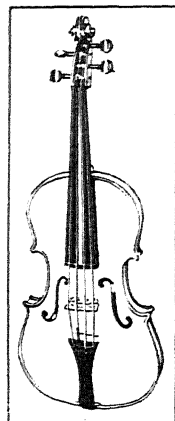
VINYL ACETATE, a colorless liquid, with an irritating odor, having the formula $\text{CH}_3\text{COOCH} = \text{CH}_2$. It is slightly soluble in water, but miscible with organic solvents, and displays the typical properties of an ESTER and an ethylenic body (see ETHYLENE). It boils at 73° C. and has a specific gravity of 0.934. Polymerizing readily to high molecular compounds, it is prepared from ACETYLENE and ACETIC ACID in the presence of a mercury salt. It is used in preparing plastics and resins.

VIOL, a stringed musical instrument, played with a bow, also the family name of a group of such instruments used during the 15th, 16th, and 17th centuries. The discant or treble viol took the part now assigned to the violin, while the *viola da braccio*, or tenor viol, was the counterpart of the modern viola, and the *viola da gamba*, or bass viol, was the counterpart of the modern violoncello, although these various viols were larger and cruder than their descendants.



COURTESY M. M. OF ART
FRENCH BASS VIOL,
18TH CENTURY

VIOLA, a stringed musical instrument furnishing the tenor part in the string-quartet and the same part in the string-section of the modern ORCHESTRA. It originally was called the *viola da braccio*, literally, arm-



COURTESY M. M. OF ART
EUROPEAN VIOLA,
19TH CENTURY

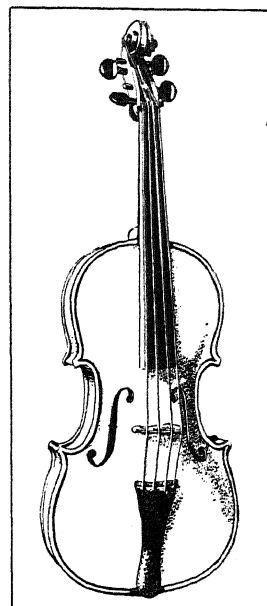
viol, to distinguish it from the *viola da gamba*, leg-viol, which was the forerunner of the violoncello. Music for the viola is commonly written in the alto (c) CLEF. It is furnished with four strings having the *accordatura* c—g—d'—a' and has a compass from c to e''' (see OCTAVE for an explanation of this terminology). Its tone is somewhat darker than that of the violin and smaller than the violoncello's. Physically it is slightly larger than the former instrument, but its technique is almost identical. The *viola d'amore* (literally love-viol) is a modification of the sixteenth-century tenor-viol, having seven principal strings tuned to the *accordatura* d—f#—a—d'—f#—a'—d'', and seven sympathetic

strings tuned in unison with the principal strings. The instrument is now seldom used.

VIOLET, a numerous genus (*Viola*) of small herbs or rarely subshrubs of the violet family, many of which bear beautiful flowers in early spring. There are upwards of 250 species native to north and south temperate zones several of which are favorite garden flowers. In North America there are 75 native species together with a large number of natural hybrids found chiefly east of the Rocky Mountains. The herbaceous species comprise two groups, the stemless and the leafy-stemmed violets. They grow usually in moist or wet soils and occur most abundantly in woods, thickets and low meadows. Because of their common occurrence and the unusual attractiveness of their flowers, violets rank among the best known and most highly prized plants of the North American flora. The flowers of the herbaceous species are usually of two kinds: 1. those which appear in early spring bearing showy petals varying from blue and white to cream-colored, yellow and rose; these rarely produce seeds; 2. those which appear in summer without petals and borne beneath the leaves (cleistogamous); these produce abundant seeds. The petal-bearing flowers are usually nodding with the lower petal prolonged into a spur and the other four in two unlike pairs. This structure gives the violet its characteristic appearance. Three Old World species, the sweet or florists' violet (*V. odorata*), the horned violet or bedding pansy (*V. cornuta*) and the pansy (*V. tricolor* var. *hortensis*), all old garden flowers, are very widely grown in numerous hybrid and cultural forms. Many native American violets are more or less grown in gardens, especially the handsome bird's-foot violet (*V. pedata*). See also PANSY.

VIOLIN, a stringed musical instrument of great antiquity in its primitive forms and in many respects

the most versatile of all musical instruments. Its origin is shrouded in darkness, but the Indian *ravanastron*, the Arabian *rebab*, and the Welsh *crwth* are generally recognized as the chief of its antecedents. It appears to have reached something approaching its present stage of development toward the latter part of the 15th century under the hands of Gaspar Duifoprugcar, known also as Tieffenbrucker, although Gasparo da Salo, early in the 16th century, shared those honors. Under the guiding genius of the greatest violin makers of all time, AMATI, Guarneri, and STRADIVARI, the instrument reached a pitch of perfection during the next century that has never been surpassed. Unlike such stringed instruments as the lyre, lute, and harp, it is equipped with a bow which, in passing across the strings, vibrates them continuously so that tones may be given any duration, although plucking the strings (*pizzicato*) is also possible. The four strings with which it is furnished are tuned at intervals of perfect fifths, the first string being the highest, the fourth the lowest, yielding the following *accordatura*:



COURTESY M. M. OF ART
VIOLIN
European, 19th century



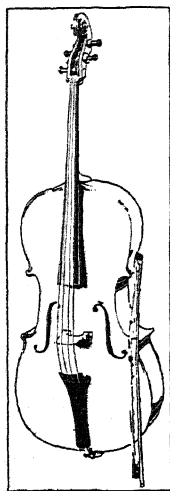
In order to raise the normal pitch of any string it is pressed, or "stopped," by one of the fingers of the left hand which controls the finger-board while the right hand sets the shortened string in vibration by means of the bow. If two tones are to be produced simultaneously the bow engages two strings simultaneously. Sounding more than two tones together is impossible, owing to the shape of the "bridge" which separates the strings from the sounding-board, but a close approximation to chords may be effected when the angle of the bow is changed rapidly. Obviously, since the lowest string is tuned to G, no tone lower than that can be generated; theoretically, there is no upper limit to the violin's compass, but e''' is commonly recognized as that acute limit, and between these two tones a full chromatic scale, composed of intervals as minute as the performer's ear can distinguish, is technically possible. The celebrated violin virtuosi in history include Arcangelo Corelli (1653-1713), Giuseppe Tartini (1692-1770), Rudolf Kreutzer (1766-1831), NICOLÒ PAGANINI (1782-1840), Ludwig Spohr (1784-1859), OLE BULL (1810-80),

JOSEPH JOACHIM (1831-1907), Henri Wieniawski (1835-80), Pablo Sarasate (1844-1908), FRITZ KREISLER (1875-), Jacques Thibaud (1880-), ALBERT SPALDING (1888-), MISCHA ELMAN (1891-) and JASCHA HEIFITZ (1901-).

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VIOLLET-LE-DUC, EUGÈNE EMMANUEL (1814-1879), French architect, was born in Paris, Jan. 21, 1814. He studied at the College Bourbon, Paris, and in the atelier of Achille Leclère, after which he traveled through France and Italy, studying and sketching ecclesiastical structures. In 1840 he returned to France and began his work of restoring various French churches. He was commissioned in 1842 with Lassus to direct the restoration of the cathedral of Notre Dame at Paris for which he designed the central spire and great altar, the new sacristy and the treasury adjoining the retro-choir. From 1849 to 1874 he was architect of the diocesan buildings of Rheims and Amiens, and in 1873 began the restoration of the cathedral of Lausanne, Switzerland. He designed the fine spire of the latter church. The sum of his work included restoring many old and designing many new structures throughout France, and the publication of several important treatises on architecture. He died at Lausanne, Switz., Sept. 17, 1879.

VIOLONCELLO, a stringed musical instrument furnishing the bass part of the string-quartet and either the bass or tenor part of the string-choir of the modern ORCHESTRA. It is a descendant of the *viola da gamba* of the 16th century (see VIOL). It is furnished with four strings yielding the *accordatura* C—G—d—a and has a compass extending upward from C to d'' or even to g'' (see OCTAVE for an explanation of this terminology). Although it is not quite so flexible an instrument as the VIOLIN, owing to its greater size, stopped passages and technical demands of a high order are met with relative ease by a skilled performer.



COURTESY M. M. OF ART
VIOLONCELLO
European, 19th
century

VIOSTEROL: Use in rickets. See CHILDREN, DISEASES OF: Digestive and Nutritional Disorders; see also LIGHT, ARTIFICIAL, IN TREATMENT OF DISEASE.

VIPER, the common name for members of a family (*Viperidae*) of poisonous snakes. They have two large poison fangs in their upper jaws. These fangs are supported by a movable bone, and are usually folded down parallel to the roof of the mouth. If a poison fang is lost it is soon replaced. Most vipers secrete extremely virulent poison, which is likely to be fatal to man. They do not, however, go out of their way to bite, as many people seem to believe,

but, on the contrary, seldom strike unless seriously frightened or suddenly startled. There are two groups of vipers, the true vipers, or adders, and the pit-vipers (*Crotalinæ*) such as rattlesnakes, and the WATER-MOCCASIN, COPPERHEAD, FER-DE-LANCE, and BUSH-MASTER. See also ADDER.

VIPER'S BUGLOSS (*Echium vulgare*), a biennial herb of the borage family called also blue weed. The plant is a native of Europe and western Asia widely naturalized in eastern North America where it sometimes becomes a troublesome weed. It is a bristly-hairy, somewhat prickly plant with a stiff, erect, much branched stem, about 2 ft. high, bearing narrow leaves and numerous handsome bright blue flowers in short, one-sided spikes.

VIRCHOW, RUDOLF (1821-1902), German pathologist, was born Oct. 13, 1821, at Schivelbein in Pomerania. He graduated at the University of Berlin in 1843, became Froriep's prosecutor at the Charité Hospital in 1845 and full prosecutor in 1846, and in 1847 founded the *Archiv für pathologische Anatomie*. In 1848, Virchow was sent by the Prussian government to investigate the epidemic of typhus fever among the weavers of Upper Silesia. He made various recommendations for hygiene and also concerning democracy and freedom for these unfortunate people, the latter getting him into serious difficulties with the government and depriving him of his post as prosecutor. He was successful, however, in obtaining the chair of pathological anatomy at Wurzburg, where he soon established a brilliant reputation for himself as a lecturer and teacher. Because of this enviable record, he was recalled to Berlin with honors and appointed professor of pathology at that university, and assumed at the same time the directorship of the Pathological Institute which had been erected for him. Virchow was considered the most influential medical personality in the Prussian capital, and in the later years of his life was the recipient of many honors. Shortly before his death, he saw the completion of the municipal hospital in Berlin (Jan. 15, 1902) which now bears his name. Virchow's greatest achievement was in pathological investigation. His writings on pathology, anthropology and social and political questions were numerous. M. F.

VIRELAY, a French verse-form invented in the 13th century and very popular in the 14th century. The virelay is a not very important loose form, and may consist either of short lines running on two rhymes with a refrain at intervals, or of several stanzas made up of longer and shorter lines, the lines of the same length rhyming within the stanza, with the rhyme of the shorter lines of one stanza forming the rhyme of the longer lines of the succeeding stanza. Of the various 19th century English poets who attempted to revive the virelay, the most successful was Austin Dobson.

VIREO, one of a family (*Vireonidæ*) of small passerine birds of the New World. There are about 100 species and subspecies found most numerous in the tropics but ranging practically throughout the

temperate regions, 25 reaching the United States, all migratory except in the extreme South. They are plainly colored birds usually olive or grayish above and whitish or yellowish below. Arboreal in habit,



WHITE-EYED VIREO
Young bird getting ready to
leave its nest

vireos frequent trees in open forests, parks or swamps, going singly or in pairs and keeping for the most part to the higher branches. They feed chiefly on insects and build neat, thin-walled, cup-like nests suspended from twig forks, in which they lay white, dark-speckled eggs. Most vireos sing pleasingly; a few are excellent songsters.

The most common species is the red-eyed vireo (*Vireo olivaceus*), widely distributed in temperate North America except in arid districts, and wintering in South America. It has a monotonous but not unpleasant song. Other well-known species are the warbling vireo (*V. gilvus*), found generally throughout North America, and the solitary or blue-headed vireo (*Vireo solitarius*) and the white-eyed vireo (*Vireo griseus*) of eastern North America.

VIRGIL. See VERGIL.

VIRGINIA, a South Atlantic State, one of the original thirteen states of the United States, popularly called the "Old Dominion." It is situated between 36°30' and 39°30' N. lat. and 75°15' and 83°40' W. long. On the west and northwest the state is bounded by Kentucky and West Virginia, on the northeast by Maryland from which it is separated by the Potomac River, on the east by the Atlantic Ocean, and on the south by North Carolina and Tennessee. Virginia comprises an area of 42,627 sq. mi., inclusive of 2,365 sq. mi. of water surface, with a maximum length of 440 mi. from east to west and a maximum breadth of 200 mi. from north to south. In size Virginia ranks thirty-third among the states of the Union.



VIRGINIA STATE SEAL

Surface Features. The surface land of Virginia falls into three strongly marked divisions, a coastal plain or tidewater region, Piedmont plateau and Appalachian Mountain province. The long even crest of the Blue Ridge which crosses the state from north to southwest is the dominating feature. Its height increases gradually from 1,500 ft. at Harpers Ferry to 5,719 ft. on Mt. Rogers in Grayson Co., the latter being the highest elevation in the state. Its mean elevation is 950 ft.

Immediately northwest of this range is a section of

the Great Appalachian valley, locally known as the Shenandoah valley, which is celebrated for its historical associations and beauty of landscape. It is subdivided into five river valleys, the northern third belonging to the Shenandoah, the middle part to the headwaters of the James and Roanoke, and the southern section to the New and Holston rivers. The erosion of its limestone basement has resulted in curious and remarkable formations, notably Shenandoah caverns, Endless Caverns, Blue Grottoes and the Natural Bridge.

West of this valley and geographically included in it, are a series of parallel ridges 1,500 to 4,000 ft. high. They include the Shenandoah, Massanutten, North and part of the Cumberland mountains.

East of the Blue Ridge is the Piedmont plateau, an undulating upland, crossed by the valleys of the Roanoke, James and Rapidan rivers. It terminates at the east with the fall line which is defined roughly by a line drawn north and south through Richmond. Between the Piedmont and the sea is the tidewater country, cut almost to the fall line by the wide estuaries of rivers. In the extreme southeastern part is a marsh covering 700 sq. mi., known as the Dismal Swamp.

The state has in all 780 mi. of shoreline. Its Atlantic coast has many islands off shore as well as barrier beaches and lagoons.

Climate. Because of its situation within three major provinces, the coastal plain, the Piedmont plateau and the Appalachian Mountains, Virginia varies considerably in climate. The mean annual temperature is 55.7° F. varying from 59.5° F., with an average of 78.7° F. in July and 40.6° F. in January, at Norfolk in the coastal plain district to 57.6° F., with an average of 77.5° F. for July to 37.5° F. for January, at Lynchburg in the more mountainous district. During the period 1892-1930, the highest temperature recorded in Virginia was 109° F. and the lowest, -29° F. The average annual precipitation is 42.3 in., ranging from 40.5 in. at Lynchburg to 44.1 in. at Norfolk. Average growing seasons range from 237 days at Lynchburg to 182 days at Norfolk.

Forests and Parks. Approximately 54% of the state of Virginia is wooded. In the coastal plain region which extends inland to the fall line the principal trees are loblolly pine, sweet gum, black gum, yellow poplar, hickory, soft maple, and red, black and pin oaks. Woodlands cover about two-thirds of this section. Characteristic trees of the DISMAL SWAMP region of the southeastern corner are live oak, magnolia, bald cypress, black and water gums, yellow jessamine, cane, southern white cedar and long leaf and loblolly pines. The Piedmont plateau lying between the fall line and the eastern base of the Blue Ridge has a mixed hardwood forest in which sassafras, hackberry, sycamore, redbud and short leaf pine are common in addition to the hardwoods of the coastal plain. The Blue Ridge, Shenandoah valley and lower ridges of the Appalachian Mountains in the western part of the state are characterized by a mixed coniferous and hardwood

forest. A typically northern coniferous forest of evergreens occupies a limited area in the high Appalachian ridge in the extreme southwestern portion. There are four national forests, the Monongahela, Natural Bridge, Shenandoah and Unaka, having a total net area in Virginia of 59,594 acres. These forests are located in the western mountainous section and are well developed for camping and other recreational use. They contain excellent stands of virgin timber though the ravages of fire have taken a heavy toll. Gallion State Forest is located in Prince Edward Co. It consists of 588 acres of second-growth hardwood and pine timber and is used as a game preserve and as a demonstration area of practical utility timber culture. George Washington Birthplace National Monument and the newly created Colonial National Monument are points of historical interest. Petersburg, and Fredericksburg and Spotsylvania parks commemorate battles of the Civil War and are administered by the War Department.

Minerals and Mining. Although Virginia possesses extensive and varied mineral resources, commercial production is limited mainly to the mining of coal, the quarrying of building stone, and to operations utilizing zinc ores and clay, sand and gravel deposits. With mineral productions in 1929 amounting to \$39,752,683, Virginia stood twenty-fifth among the states, ranking third in pyrites, fourth in slate, eighth in lime and ninth in coal. The principal products in order of value were coal, 12,748,306 tons, \$20,942,000; limestone, \$3,011,695; clay products exclusive of pottery, \$2,948,309; zinc, about \$1,500,000; sand and gravel, 1,728,590 tons, \$1,165,358; lime, 153,170 tons, \$1,061,018; granite, \$861,347; and slate, \$850,882.

During 1929 208 mines and quarries gave employment to 16,091 persons who received \$16,703,622 in salaries and wages; of these 12,478 were engaged in the coal mining industry.

Soil. The most fertile and highly productive areas in the state are found in the valley of Virginia and in other valleys of the Newer Appalachians which are largely overlaid with rich limestone soils. The coastal plain region or Tidewater Virginia, embracing about one-fourth of the area of the state, contains valuable soils consisting of sandy loams with a subsoil of sandy clays. Portions, however, are sandy, light, and comparatively infertile. In the lower parts of the plain there are swampy areas which, when properly drained, become exceedingly productive. The Piedmont region, lying between the coastal plain and the foot of the Blue Ridge Mountains and embracing two-fifths of the total area of Virginia, possesses only moderately fertile soils. In general these vary from sandy to red clay types in accordance with the character of the underlying crystalline rocks. Wholly unproductive are the rugged elevations of the Blue Ridge Mountains which occupy a total area of about 2,500 sq. mi.

Agriculture. Corn, tobacco, hay, potatoes, vegetables and fruits constitute the principal crops.

In 1930 16,728,620 ac. or 64.9% of the entire land area was in farms, 170,610 in number, with an aver-

age size per farm of 98.1 ac. and an average value per acre of \$51.16. Of the farm area 5,058,317 ac. was crop land; 5,593,348 ac., pasture land; and 5,167,430 ac., woodland. The total value of farm property was \$992,824,691, of which \$855,849,672 was represented by land and buildings; \$44,319,253, by implements and machinery; and \$92,655,766, by domestic animals.

According to the census of 1930 Virginia produced in 1929 field crops to the value of \$156,930,432, ranking twenty-fifth among the states. It stood third in tobacco, fourth in cabbages, sixth in sweet potatoes, seventh in potatoes, and eighth in beans; it also ranked third in apples, eighth in strawberries, ninth in pears and twelfth in peaches. The chief crops were grains valued at \$52,066,815; vegetables, \$41,349,484; tobacco, 115,825,610 lbs., \$20,269,482; fruits, \$19,352,292, and hay and forage, 980,737 tons, \$18,569,575. The grains included corn 32,772,810 bu., wheat 8,575,461 bu., oats 1,127,824 bu., rye 440,334 bu. and barley 331,884 bu. Among the vegetables were potatoes valued at \$19,055,270; sweet potatoes, \$4,538,336; tomatoes, \$1,923,628; cabbages, \$1,284,617; beans, \$777,346, and spinach, \$763,115. The leading fruit crops were apples 13,054,338 bu., peaches 1,057,541 bu., pears 401,795 bu., grapes 3,571,045 lbs., figs 187,456 lbs. and strawberries 15,978,161 qts. Cotton, 52,442 bales, was valued at \$4,457,570 and cottonseed, 25,266 tons, \$757,980.

Farm products sold by cooperative marketing fell from \$10,186,092 in 1919 to \$8,792,136 in 1929. Farm machinery and equipment in 1930 included 88,463 automobiles, 19,459 motor trucks, 9,757 tractors, 3,632 electric motors and 10,298 stationary gas engines.

Animal Industry. Cattle-raising, chiefly for milk production, is the principal livestock interest. According to the census of 1930, Virginia ranked twenty-second among the states in total value, \$92,655,766, of domestic animals on farms. Among these were 832,946 cattle, valued at \$43,622,495; horses, 203,174, \$16,750,430; mules, 94,573, \$10,476,511; swine, 699,867, \$7,391,990, and sheep, 828,526, \$7,151,409.

Of the cows on farms, 384,623 were kept mainly for milk production and 48,359 mainly for beef production. In 1929, 145,524,668 gals. of milk were produced; the total value of dairy products sold was \$16,262,418. The value of all poultry raised was \$16,157,585. The number and value of the chief kinds were, chickens, 16,728,622, \$14,241,186; turkeys, 527,715, \$1,735,128; ducks, 127,318, \$114,587, and geese, 37,463, \$66,684. The chickens sold, 7,647,829 in number, were valued at \$6,951,401. Of 55,349,206 doz. chicken eggs produced, valued at \$17,120,084, 39,482,731 doz., with a value of \$12,233,383, were marketed. The wool clip, 2,073,165 lbs., was valued at \$777,276. Honey, amounting to 1,237,250 lbs., valued at \$281,988, was produced from 105,347 hives.

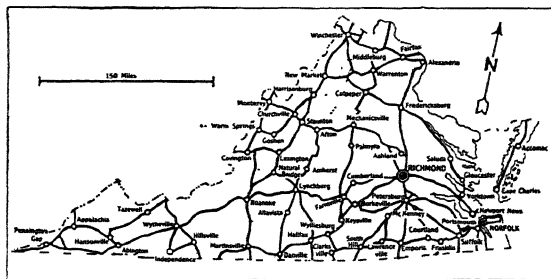
Fisheries. Virginia ranked sixth in the value of its fisheries in 1930, the total catch amounting to 211,286,000 lbs., worth \$7,286,000. Oysters, shad, menhaden, weakfish, alewives, croaker, butterfish, crabs

and clams are the leading species taken. Practically all fishing is from small boats in Chesapeake Bay.

There is considerable inland game fishing, and in 1930 144,215 licenses were issued to sportsmen who paid \$249,373 in fees. Four fish hatcheries were operated in 1930 at a cost of \$30,000 and the output was over 25,000,000 game fish of various species. In addition, the U.S. Bureau of Fisheries planted in state waters 1,800,000 shad, 278,549 rainbow trout, 298,200 brook trout, 186,000 bass, 80,150,000 yellow perch and 64,000 other game fish.

Transportation. Virginia is favored with good transportation facilities both by land and water routes. The James, Rappahannock, and Potomac rivers are navigable for boats of light draught, and are of local commercial importance. Hampton Roads, at the mouth of the James River, forms the harbor for Norfolk and Newport, the state's leading ports. It is a shipbuilding center and affords both coastwise and ocean-going transportation facilities. Virginia also has an efficient steam railway network. In 1930 the total steam railway mileage was 4,505, with the Southern, the Atlantic Coast Line, the Virginian, the Seaboard Air Line, the Norfolk and Western and the Chesapeake and Ohio the principal systems.

The state highway system is well maintained with a total highway mileage of 72,025 on Jan. 1, 1930. This included 12,327 mi. of surfaced roads and 4,983 mi. of improved state highways. During 1929, high-



VIRGINIA STATE ROADS

way expenditures were \$22,179,128, of which \$13,953,848 was paid by the state and \$8,225,128 by county and local governments. Gasoline consumption aggregated 228,453,000 gals. in 1930. The state gasoline tax that year produced an income of \$10,775,058 as against \$5,855,670 in 1925. Motor vehicle registrations were 375,889 in 1930 compared with 282,650 in 1925. The rapid growth of transportation by truck is indicated by truck registrations, which rose from 35,700 in 1925 to 57,307 in 1930, or over 60%. During the same period the number of buses in operation increased from 1,254 to 2,183, or about 75%.

Manufactures. The manufactures of Virginia, which have increased greatly in variety and volume since 1900, are based in the main on the state's mineral, agricultural and forest resources.

According to the census of 1930 Virginia with manufactures for 1929 valued at \$745,910,075 stood twentieth among the states. Its 3,287 establishments

gave employment to 11,313 officers and employees, who received \$29,263,340 in salaries, and to 120,273 wage earners, who were paid \$118,088,986 in wages. These factories used a total of 646,251 horse power, expended \$15,642,018 for fuel and power, and \$350,182,323 for material and supplies, and added by the process of manufacture \$380,085,734 to the value of their output.

In this output there were 77 separately enumerated groups of manufactures. The state stood second in cigars and cigarettes, third in ship building, fourth in fertilizers, seventh in wood pulp and eleventh in steam railway carshop construction and repairs and furniture. The outstanding industry was the manufacture of cigars and cigarettes with an output valued at \$147,701,545 or 20% of the total for the state. Among other important manufactures, with their value, were railway carshop construction, \$33,271,215; furniture, \$28,221,183; ship building, \$25,292,845; cotton goods, \$25,038,049; paper, \$20,967,376; chemicals, \$20,681,676; fertilizers, \$20,661,916; lumber, \$20,656,537; printing and publishing, \$20,108,433; flour, \$18,865,489; tobacco and snuff, \$17,744,996, and wood pulp, \$14,203,969.

The leading manufacturing cities with value of output were Richmond, \$217,996,635; Norfolk, \$57,876,997, and Lynchburg, \$31,594,147.

Commerce. According to the census of 1930, there were in 1929 2,344 wholesale establishments in Virginia, with total sales of \$656,308,593. These organizations gave full-time employment to 22,739 men and women, whose annual salaries and wages aggregated \$30,171,574. The chief distributing centers are Richmond and Norfolk.

The total sales of the 26,222 retail stores amounted to \$596,784,504. Sales per store averaged \$22,759; sales per capita were \$246.42.

CHIEF RETAIL DISTRIBUTING GROUPS

Group	No. of Stores	Sales	% of Total
General Mdse.	6,359	\$141,383,539	23.70
Food	8,001	121,376,544	20.35
Automotive	3,971	116,475,349	19.51
Apparel	1,332	46,825,536	7.84
Lumber & Bldg.	822	39,658,741	6.66
Furn. & Household ..	680	26,573,648	4.46
All other stores	5,057	104,491,147	17.48
Total, all stores ...	26,222	\$596,784,504	100.00

Norfolk, the principal port, handled water-borne traffic amounting to 16,552,892 tons with a value of \$816,298,165. Newport News, which handled 8,563,589 tons with a value of \$129,602,848, was also important. Coal was the most important item.

Finance and Banking. The assessed value of all taxable property in 1928 was \$2,191,753,333. The total bonded debt on Dec. 31, 1929 was \$25,270,233. The total state revenues in 1929 were \$46,472,969; total disbursements were \$42,782,772. The chief sources of income were property, corporation, motor vehicle and gasoline taxes. The principal payments were for highways and education.

There were 478 banks in Virginia in 1930. Of these, 158 were national banks, 313 trust companies and state banks and 7 private banks. Their total capitalization was \$58,455,934; their surplus and undivided profits, \$52,309,000. Total resources were \$663,460,000, with loans and discounts aggregating \$438,094,000. Demand and time deposits totaled \$453,550,000. Per capita demand and time deposits were \$186.80; per capita savings deposits, \$101.86. The total savings of \$247,306,000 were owned by 499,530 depositors. National bank circulation aggregated \$19,367,000.

Government. The legislative body of Virginia, known as the General Assembly, consists of a Senate composed of 40 members and a House of Delegates of 100 members, the former elected for terms of four years and the latter for terms of two years. They meet in biennial sessions limited in duration to 60 days. The chief executive is the governor elected for terms of four years at a salary of \$5,000 per year. Other executive officers are the lieutenant governor, secretary of the commonwealth, treasurer and auditor of public accounts. Judicial power is vested in a supreme court of appeals and in circuit and city courts. The supreme court of appeals consists of five judges chosen by the legislature for terms of twelve years. The chief justice receives a salary of \$5,200 per year and the other judges salaries of \$5,000 per year.

Social Welfare Institutions. The Department of Public Welfare controls all the charitable and penal institutions in the state. A home and school for the deaf and blind is located at Staunton and one for the colored deaf and blind is at Newport News. The Virginia Commission for the Blind has its office at Richmond with workshops at Norfolk, Charlottesville, Lynchburg and Richmond. The Confederate Soldiers' Home at Richmond is owned by Lee Camp veterans, but maintained by the state. At Bon Air is a home and industrial school for white girls and a similar institution for boys is at Maidens. The colored girls' industrial school is at Peaks Turnout and the colored boys' at Hanover. A colony for epileptics and feeble-minded is at Colony; sanatoriums for incipient tuberculosis are at Catawba and Charlottesville for white patients and at Burkeville for colored patients. Hospitals for the white insane are located at Staunton, Marion and Williamsburg, for colored insane at Petersburg. At Staunton is a state convict lime-grinding plant and a state farm is run at State Farm. The penitentiary is in Richmond.

Education. The first schools of which there is any record were conducted by missionaries after the founding of the English colony in 1607. Early efforts to found a college in Virginia were frustrated by the Indian massacre of 1622. A school was opened in Elizabeth Co. in 1636, and other schools were founded in the colony prior to 1650. A law to establish public schools was enacted in 1796. Separate schools are maintained for Negroes. In 1927-28 there were 490,674 enrolled pupils in the public elementary schools, with 13,644 teachers. In the 359 public high schools

there were 63,043 pupils and 3,207 teachers. Children from 8 to 12 years of age are required to attend school 12 weeks of the year.

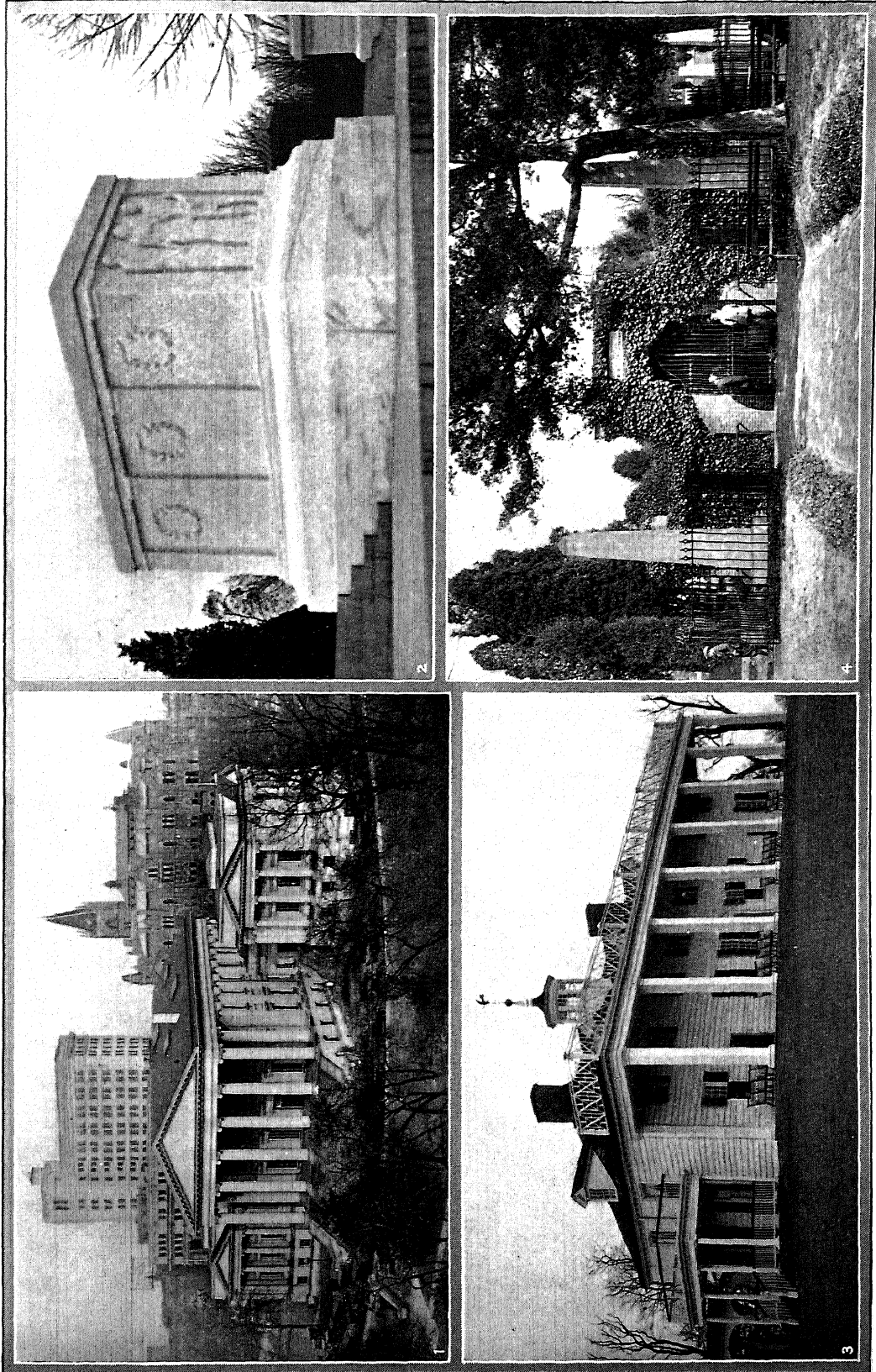
The number of persons from 5 to 20 years of age attending school in 1930 was 530,683, or 62.6% of the population within the ages specified, as compared with 489,319, or 59.3%, in 1920. The number of persons, 10 years and over, unable to read and write in 1930 was 162,588, or 8.7%, as compared with 195,159, or 11.2%, in 1920. The number of Negro illiterates was 95,148, or 19.2% in 1930, a noteworthy decrease from the 122,322 Negro illiterates, or 23.5%, in 1920. Native white illiterates numbered 65,482, or 4.8% in 1930, and 70,475, or 5.9%, in 1920.

The institutions of higher learning maintained by the state include the University of Virginia at Charlottesville; the College of William and Mary at Williamsburg; the Virginia Polytechnic Institute at Blacksburg; the Medical College of Virginia at Richmond; the Virginia Military Institute at Lexington; teachers colleges at Farmville, Fredericksburg, Harrisonburg and Radford; and, for Negroes, the Hampton Normal and Industrial Institute at Hampton, and a normal school at Petersburg. Important among the private educational institutions are Washington and Lee University at Lexington, Roanoke College at Salem, University of Richmond, Emory and Henry College at Emory, Hampden-Sidney College at Hampden-Sidney, Randolph-Macon College at Ashland and Randolph-Macon Woman's College at Lynchburg. The leading institution for Negroes is Virginia Union University at Richmond. The Virginia State Library Commission has its headquarters in the State Library at Richmond.

Population. In 1930 Virginia ranked twentieth among the states with a population of 2,421,851 or 60.2 per sq. mi., an increase of 112,664 or 4.9% over 1920. The population rose from 747,610 in 1790 to 1,596,318 in 1860, 1,854,184 in 1900, 2,061,612 in 1910, and 2,309,187 in 1920. In 1930 there were 1,770,405 or 73.1% whites, 650,165 or 26.8% Negroes, and 779 Indians, an increase from 1920 of 9.4% whites and 5.8% Negroes. Of the whites, 1,746,585 were native-born and 23,820 were foreign-born. The rural population was 1,636,314 or 67.6% of the total, an increase of 1,111 or 0.1% from 1920; the urban population was 785,537 or 32.4% of the total, an increase of 111,553 or 16.6% since 1920. In 1930 the seven largest cities were Richmond, 182,929; Norfolk, 129,710; Roanoke, 69,206; Portsmouth, 45,704; Lynchburg, 40,661; Newport News, 34,417; Petersburg, 28,564.

Occupations. In 1930 880,211 persons, or 36.3% of the population, were gainful workers 10 years old or older; 79.3% of these were males and 20.7% were females; 69.1% were native white; 1.5% foreign-born white, and 29.3% Negro. Among the chief occupations, with number of workers, were farmers, 150,464, and farm wage workers, 82,057; factory operatives, 32,961 men and 24,553 women; servants, 6,295 men and 40,608 women; factory laborers, 41,108 men and 4,394 women; clerks, 20,033 men and 8,942 women;

VIRGINIA



1. COURTESY CHAMBER OF COMMERCE, RICHMOND, VA.; 2. PUBLISHERS' PHOTO SERVICE PHOTO; 3, 4. EWING GALLOWAY PHOTOS

NATIONAL SHRINES AND HISTORIC BUILDINGS IN VIRGINIA

1. Virginia Capitol Building, Richmond, designed by Thomas Jefferson; the wings were added in 1902.
2. Tomb of the Unknown Soldier at the entrance to the Memorial Amphitheater, Arlington, dedicated in 1932.
3. Mount Vernon, home of George Washington in Fairfax County.
4. Burial vault of George Washington and of his wife, Martha, at Mount Vernon.

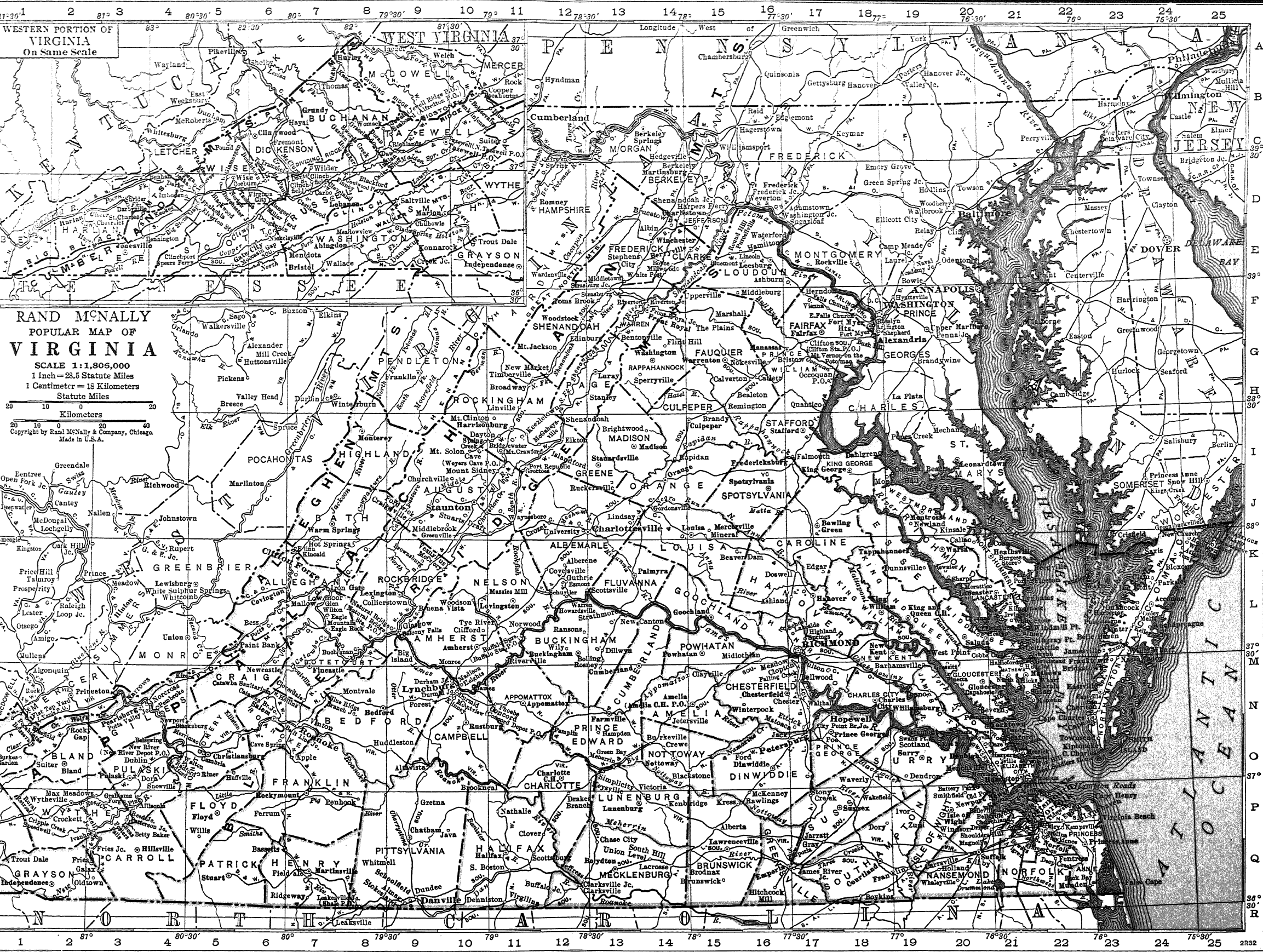
VIRGINIA

Area, 42,627 sq. m.
Pop. 2,421,551

PRINCIPAL CITIES

Pop.—Thousands

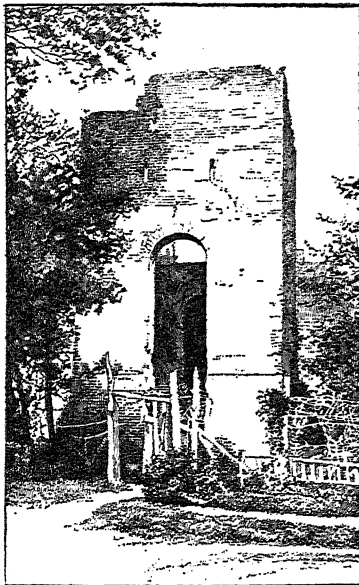
- 3 Abingdon... E 8
- 24 Alexandria G 18
- 1 Almasro... R 9
- 2 Altavista... O 4
- 4 Appalachia... F 18
- 1 Ballston... F 18
- 2 Bassett... O 6
- 4 Bedford... N 8
- 1 Berryville... E 14
- 4 Big Stone Gap... D 4
- 1 Blacksburg... O 5
- 2 Blackstone... O 14
- 4 Bluefield... N 1
- 9 Bristol... E 7
- 4 Buena Vista... L 9
- 3 Cape Charles... N 22
- 15 Charlottesville... K 12
- 2 Chase City... Q 13
- 1 Chatham... Q 9
- 2 Chicopee... K 25
- 2 Christiansburg... O 5
- 7 Clifton Forge... L 7
- 7 Covington... L 6
- 2 Crewe... O 14
- 2 Culpeper... H 14
- 2 Damascus... E 8
- 22 Danville... R 9
- 3 East Falls Church... F 18
- 3 E. Radford... O 4
- 2 Emporia... Q 13
- 1 Ettricks... L 17
- 2 Falls Church... F 18
- 3 Farmville... N 13
- 2 Fieldale... Q 7
- 3 Ft. Eustis... Q 20
- 1 Fox Hill... O 21
- 3 Franklin... Q 19
- 7 Fredericksburg... I 17
- 2 Fries... O 2
- 2 Front Royal... F 14
- 3 Galax... Q 3
- 6 Hampton... O 21
- 7 Harrisonburg... I 11
- 11 Hopewell... N 17
- 2 Lawrenceville... Q 15
- 2 Leesburg... E 18
- 4 Lexington... Q 19
- 1 Lowmoor... L 7
- 41 Lynchburg... N 10
- 2 Madison Heights... N 10
- 4 Marion... D 10
- 8 Martinsville... Q 7
- 4 National Soldiers Home... O 21
- 34 Newport News... P 21
- 130 Norfolk... P 21
- 2 N. Emporia... Q 17
- 3 Norton... D 5
- 1 Orange... J 14
- 2 Pennington Gap... E 4
- 29 Petersburg... O 17
- 3 Phoebus... O 21
- 3 Pocahontas... N 1
- 46 Portsmouth... P 21
- 7 Pulaski... O 3
- 6 Radford... O 4
- 1 Richlands... O 8
- 183 Richmond... M 17
- 69 Roanoke... N 7
- 5 Salem... N 6
- 3 Saltville... D 9
- 5 So. Boston... Q 11
- 8 So. Norfolk... Q 22
- 12 Staunton... J 10
- 2 Strasburg... F 13
- 10 Suffolk... Q 20
- 1 Tazewell... C 10
- 1 Toano... N 19
- 2 Victoria... P 14
- 4 Vinton... N 7
- 2 Virginia Beach... P 23
- 1 Waverly... P 18
- 2 Waynesboro... J 11
- 2 West Point... M 19
- 4 Williamsburg... N 20
- 11 Winchester... E 14
- 2 Woodstock... F 12
- 3 Wytheville... P 2



retail dealers, 26,777; salespersons, 18,617 men and 7,150 women; school teachers, 2,489 men and 16,276 women; carpenters, 18,008; general building laborers, 16,046; laundresses, 14,139; chauffeurs, 13,366; coal mine operatives, 12,630, and steam railroad laborers, 11,496.

HISTORY

The Virginia Company of London, chartered by James I on Apr. 10, 1606, dispatched an expedition under Christopher Newport which, reaching Cape Henry on Apr. 26, 1607, explored Chesapeake Bay, and founded Jamestown on May 14, the first permanent English settlement in America, on a peninsula about 40 miles up the James River. The firmness and energy of JOHN SMITH maintained the community through straitened circumstances and against Indian hostility. Other colonists arrived in 1609. Virginia entered a colonial era of increasing popula-



RUINS OF THE OLD CHURCH, JAMESTOWN, VIRGINIA
The first Anglican church built in America

tion and prosperity, punctuated by minor recessions; tobacco planting became the leading pursuit in the coastal plain, and the fur trade above the fall line. Hampton, 1609, was the first trading post, while Henrico and Bermuda Hundred, 1611, follow Jamestown in the list of agrarian settlements. The break-up of communal tenure, 1616; the introduction of Negro slaves, and the convening of the Virginia House of Burgesses, the first representative assembly in North America, 1619; the adoption of a constitution, written by Sir Edwin Sandys, 1621; severe Indian wars, marked by the massacre of 350 whites on the night of Mar. 22, 1622; the revocation, as an expression of Charles I's aversion to democracy, of the proprietary charter in 1624; the arrival of Sir William Berkeley as governor in 1641; and the beginning of conflict between the elective assembly and

the crown's appointees, are features of Virginia's history up to 1648, when the population had reached 15,000.

The development of a planters' aristocracy was reflected in the restriction of suffrage in 1670, and in severe laws against "nonconformists, Quakers, and Anabaptists." BACON'S REBELLION was the first outbreak of back-country democracy. Greed and rapacity characterized the administrations of successive royal governors until Alexander Spotswood's brilliant tenure, 1710-22, when exploration and the fur trade were advanced, pirates dispersed, and legitimate commerce encouraged. Involved, through its fur trade and its far-reaching claims to western lands, in the FRENCH AND INDIAN WAR from the beginning, Virginia was affronted by the selfish British colonial policy instituted after the war was concluded. Since its western counties, populated by English, Scotch-Irish, German and Scottish immigrants, were demanding equality of representation and democratization of the franchise, the Revolution was welcomed as a possible means of displacing the plantation-owning aristocracy, and of disestablishing the Episcopal Church; but the tidewater counties, having suffered economically from the recent Parliamentary impositions, also favored the Revolution. PATRICK HENRY and RICHARD HENRY LEE, political leaders of the back-country democracy, shared leadership during the Revolutionary years with George Washington, Thomas Jefferson, GEORGE MASON, Edmund Pendleton, and other leading tidewater Virginians. Gov. DUNMORE was ousted in June, 1775, and became leader of the Tory and British military forces. The famous Declaration of Rights, written by Mason, was adopted on June 15, 1776, by the convention which adopted a state constitution on the 29th. Patrick Henry was the first governor; Richmond in 1779 was named the capital. Religious freedom was established, and primogeniture and entail shortly were abolished. Virginia troops won distinction in the Hudson Valley and in the conquest of the old Northwest before the state in 1781 was itself invaded. (See REVOLUTIONARY WAR.)

The transfer of Virginia's trans-Appalachian lands to the Confederation was formally executed in March, 1784. When the federal Constitution, which James Madison, James Monroe, Edmund Randolph, and other Virginians were instrumental in shaping, was submitted for ratification, the tidewater element, anxious to safeguard the rights of property, supported it, while the western population, mistrusting any centralization of power, was in general opposed; ratification was obtained by ten votes, June 25, 1788. Madison's Virginia Resolutions (see KENTUCKY AND VIRGINIA RESOLUTIONS) and Jefferson's often-pronounced theories (see JEFFERSONIAN DEMOCRACY) expressed a fierce attachment to STATE RIGHTS theories, while the Virginian-born John Marshall conversely was strengthening the nationalistic tendencies of the federal Government. Virginians occupied such prominent posts that the phrase "Virginia dynasty" not inaptly characterized the national administration.

After 1830 a leading cotton-producing state, thoroughly committed to the slavery cause (*see CIVIL WAR*), Virginia nevertheless opposed secession as late as April, 1861. Richmond became the capital of the Confederacy, Virginia the great battle-ground, and its citizen ROBERT E. LEE the great leader. (*See WEST VIRGINIA, History.*) RECONSTRUCTION left an immense public debt, the disposal of which for decades was a leading political issue. For sentimental reasons and to ensure the minimization of the Negro's political strength, the state was consistently Democratic; but in 1928 Virginia endorsed a Republican for President for the first time since 1872. In 1932, however, the state returned a large Democratic vote.

BIBLIOGRAPHY.—J. E. Cooke, *Virginia*, 1903; P. A. Bruce and others, *History of Virginia*, 1924.

VIRGINIA, a city in St. Louis Co., northeastern Minnesota, beautifully situated 60 mi. northwest of Duluth. Four railroads and a system of bus lines serve the city's numerous industries. The country produces farm crops, but iron is the chief product of this region which is in the center of the Mesabi Iron Range. There are several iron mines close at hand. The city ships iron ore and lumber. The retail trade in 1929 amounted to \$8,001,933. Pop. 1920, 14,022; 1930, 11,963.

VIRGINIA, UNIVERSITY OF, at Charlottesville, Va., a state institution, founded in 1819 as Central College. It was organized according to a plan for the development of a college which would grow into a university, formulated by Thomas Jefferson, rector of the board of trustees. The college became a university in 1825, and also followed his plan of having the university consist of a collection of independent schools. Until his death in 1826, he was the dominating power of the university, evolving the entire system of education and devising all features of construction and administration. The university comprises a College of Arts and Sciences, departments of Graduate Studies, Education, Engineering, Law and Medicine. Women are admitted only to graduate and professional courses. The institution had productive funds in 1931 amounting to \$10,029,624. The library contained 184,468 volumes. In 1931, there was a student enrollment of 2,524, and a faculty of 148, headed by John L. Newcomb, acting president.

VIRGINIA AND KENTUCKY RESOLUTIONS, 1798, 1799, three series of resolutions, in protest against the ALIEN AND SEDITION ACTS, defining the extreme States' Rights view of the relations of the states to the Union. The legislature of Kentucky in Nov. 1798 passed a group of nine resolutions written by THOMAS JEFFERSON, asserting in part that the Constitution was a compact of states in which certain definite powers were delegated to a central government; that whenever the general government assumes undelegated powers, as in the passage of the acts in question, "its acts are unauthorized, void, and of no force." Other states were asked to express their sentiments on the validity of the acts. The legisla-

ture of Virginia in Dec. 1798 passed eight resolutions written by JAMES MADISON, somewhat more moderate, but reaffirming the compact theory and calling upon other state legislatures to concur in declaring the acts unconstitutional and to take measures against their retention. Legislatures in several northern states responded with resolutions of disapproval; the southern states made no replies. In Nov. 1799 the Kentucky legislature passed additional resolutions, declaring that for the Federal officials to interpret the Federal Constitution was despotism. The resolutions had no immediate practical effect, but were influential in crystallizing public opinion against the FEDERALIST PARTY.

VIRGINIA COWSLIP, a name given in the eastern United States to the BLUEBELLS, a smooth perennial of the borage family bearing showy clusters of bluish-purple flowers.

VIRGINIA CREEPER (*Parthenocissus quinquefolia*), a handsome woody climber of the grape family, native to eastern North America, Mexico and Cuba and widely planted for ornament. It is a vigorous high-climbing vine with numerous tendrils usually expanded into adhesive disks, large, palmately divided leaves, small greenish flowers in irregular clusters and bluish-black, somewhat grapelike fruit. The plant, in numerous varieties and races, is grown for its attractive foliage which becomes highly colored in autumn. Like the ivy of the Old World it is used for covering walls. It is sometimes erroneously called woodbine and is one of several woody plants frequently mistaken for poison ivy from which it is readily distinguished by its five-parted leaves, the poison ivy having leaves of three leaflets.

VIRGINIANS, THE, a novel of pre-Revolutionary America, by WILLIAM MAKEPEACE THACKERAY, published as a sequel to *Henry Esmond* in 1859. The great Virginian estate, Castlewood, is autocritically governed by the widowed Rachel Warrington during the childhood of her twin sons, George and Harry. When it is reported that George, the slightly elder of the twins and hence the heir, has been killed in the French and Indian War, Harry travels to England and there meets with some extraordinary adventures among the members of the English branch of his family. The once bewitching Beatrix Esmond whom Harry's grandfather had loved, as the now aged Baroness Bernstein "befriends" the American cousin, and under her deplorable mentorship the youth almost marries an elderly spinster, his cousin, a folly from which he is barely saved by the timely arrival of George. During the Revolutionary period Harry remains in England, George returning to fight for his country. The touches of local atmosphere, both American and English, are masterly in their vividness, and there are some excellent glimpses of such great men of the day as George Washington, Dr. Johnson, Richardson and Fielding.

VIRGINIA POLYTECHNIC INSTITUTE, THE STATE AGRICULTURAL AND MECHANICAL COLLEGE, a technical school for men

and women at Blacksburg, Va. It was established in 1872 by the state under the provisions of the Federal Land Grant Act, and is supported by the state and Federal governments. The college consists of schools of Agriculture, Engineering, Business Administration and Applied Science, and maintains agricultural and engineering experiment stations and engineering extension service. The grounds and buildings were valued in 1931 at \$4,950,000. The library contained 50,616 volumes. In 1931-32 there were 1,582 students, and a faculty of 416, headed by Pres. Julian A. Burruss.

VIRGINIA UNION UNIVERSITY, at Richmond, Va., a coeducational school for Negroes, was formed in 1899 by the union of Wayland Seminary, founded in 1865 in Washington, D.C., and Richmond Theological Seminary, founded in 1865 at Richmond, Va. Although established and partly maintained by the American Baptist Home Mission Society, the university is non-sectarian. The grounds and buildings were valued in 1931 at \$850,000. The library contained 14,000 volumes. In 1930-31 there were 867 students, and a faculty of 25, headed by Pres. William J. Clark.

VIRGIN ISLANDS, BRITISH, a group of 32 small islands of the West Indies, lying east of Porto Rico and forming one of the presidencies of the Leeward Islands colony. They comprise a total area of 58 sq. mi. The principal islands of the group are Tortola, Aneganda, Virgin Gorda, Jost Van Dykes, Peter's Island and Salt Island. Road Town, on the southeast coast of Tortola, is the only town. Cotton raising was once the main industry, but sugar, tobacco and coconuts are now produced in increasing quantities. Fishing and charcoal burning are important industries. The Virgin Islands were discovered by COLUMBUS. Est. pop. 1930, 5,263.

VIRGIN ISLANDS OF THE UNITED STATES, a group of some fifty islands in the West Indies, situated about 60 mi. east of Porto Rico and 1,442 mi. southeast of New York. They have a total area of 149 sq. mi. of which 132 are contained in the three largest, St. Thomas, St. John and St. Croix.

St. Croix with an area of about 80 sq. mi. and population in 1930 of 11,413 is larger than others of the group and has the most productive soil. Sugar cane is its chief crop and considerable areas are devoted to grazing lands for cattle. The urban population centers in two towns, Frederiksted, 2,698, and Christiansted, 3,767.

St. Thomas Island is rocky and barren. It has an area of about 30 sq. mi. and a population of 9,834 of whom 7,036 live in the city of St. Thomas, the capital. This city has one of the finest harbors in the West Indies and is an important base for fueling ships with coal and oil. It is also a United States naval base. The principal product of this island is bay oil distilled from bayberry leaves.

St. John has an area of about 20 sq. mi. and a population of 765, entirely rural. The land produces small crops of cotton, sugar cane and tobacco.

Trade is mostly with continental United States. In 1929-30 exports amounted to \$794,386 and included 5,310 tons of sugar, \$392,000; 1,326 head of cattle, \$85,059; and 93,431 gallons of bay rum, \$67,558. Imports were chiefly food and wearing apparel and aggregated \$2,298,678, almost three times the income from exports. The Federal Government is working to improve economic conditions by increasing cattle industry and diversifying crops, and improving the distillation of bay oil.

The Virgin Islands were formerly administered by the United States Navy Department through a governor who was also commandant of the naval station. On Mar. 18, 1931, however, a change of administration went into effect which placed the civil government of the islands under the Department of the Interior. Education is free and compulsory. In 1928 there were 4,050 children enrolled in public and private schools.

History. CHRISTOPHER COLUMBUS discovered the Virgin Islands in 1494 and named them Las Virgenes. In 1801 Great Britain, which since 1666 had occupied Tortola, took from Denmark the islands of St. John and St. Thomas and suppressed the pirates who had long infested the neighboring islands. These islands were restored to Denmark a year later. In 1807 Britain reoccupied and held them till 1815, when they were once more restored to Denmark. It was from the latter country that in 1917, after prolonged negotiations, the United States bought these two islands and St. Croix for \$25,000,000.

Danish law, so far as compatible with the new status of the island, continues in effect. The natives were granted full American citizenship by an act of Congress, Feb. 25, 1927. The language of the islands is English. Pop. 1930, 22,012, nearly 95% Negroes.

VIRGINIUS AFFAIR, 1873, a controversy between the United States and Spain about the seizure on the high seas, contrary to international law, of the American vessel *Virginius* by the Spanish warship *Tornado*. When intercepted, the *Virginius* was carrying men and supplies from an American port, under fraudulent registration, to aid the insurrection party in Cuba. The vessel was taken into the port of Santiago, Cuba, and condemned; 53 of its passengers and crew, including American and British citizens, were summarily executed. Excitement ran high, and a prolonged diplomatic correspondence threatened to end in war. But Spain ultimately agreed to pay indemnities to the families of the executed men, return the *Virginius*, and prosecute the officers responsible for the outrage.

VIRGIN MARY. See MARY, VIRGIN.

VIRGIN'S-BOWER, the general name for a numerous genus (*Clematis*) of woody vines or sometimes erect perennial herbs of the crowfoot family many of which are cultivated as ornamentals. There are about 220 species widely distributed throughout the world but most abundant in temperate regions; some 30 species occur in North America. Among the best known North American species are the Vir-

ginia virgin's-bower (*C. virginiana*), common in the borders of thickets from Nova Scotia to Manitoba and southward to Georgia, and the western virgin's-bower (*C. ligusticifolia*), found from Missouri to Nebraska westward through the Rocky Mountain region to the Pacific coast, both with profuse white flowers and conspicuous silky fruits, and the purple virgin's-bower (*C. verticillaris*) of the northeastern states and adjacent Canada with handsome purple flowers sometimes 4 in. broad. See also CLEMATIS.

VIRGIN SOIL, a novel by IVAN TURGENIEV, published 1876, portraying vividly and poignantly a group of 19th century Russian revolutionaries. The hero of this tragic story is a young student, Neshdanoff, who, seeing injustice all around him and in poverty himself, idealistically becomes a Nihilist and works ardently but ineffectually for a social revolution. His greatest efforts seem only futile, and at last losing faith in the revolution and in himself, he advises Marianne, a girl with whom he is in love, to marry the strong-minded, admirable manufacturer, Solomine, and in utter disillusionment then kills himself.

VIRGO (gen. *Virginis*), the virgin, the sixth constellation of the Zodiac, is of very ancient origin and has for ages past been associated with agriculture, the planting season and the harvest. It is visible during the spring, and due south during early evenings in May. Its brightest star, Spica, Alpha Virginis is a blue star of the first magnitude. A third magnitude star, Gamma, at a distance of 40 light years, is a double star whose smaller component revolves around the larger one in about 180 years, describing a very elongated ellipse, at a mean distance of 360 million miles. The northern part of the constellation is very rich in spiral nebulae. Sometimes thousands of these objects may be found upon a single photographic plate of these regions. See STAR: map.

VIRTUE, IDEALS OF, standards of excellence in conduct. Among the Chinese, propriety and obedience are most highly prized. The Greeks had their cardinal virtues. Aristotle regarded virtue as a mean between extremes; thus courage was a mean between rashness on the one hand and cowardice on the other. For the Christian, faith, hope and charity constitute the trinity among the virtues. The ideals of love and chastity are also highly regarded. From these different conceptions of virtue it is apparent that virtue is a disposition manifested in conduct. Some philosophers judge virtue in terms of their consequences. Yet we often say, with Aristotle, that "Virtue has its own rewards" regardless of consequences. Although this is in some sense true it does not necessarily make the virtues absolute. Common sense would rather make them relative. Virtue is sometimes regarded simply as the fulfillment of duty, sometimes as something additional to duty. A virtuous will is one which does more in a given situation than is required by mere duty. See ETHICS.

VIRUS. See FILTER-PASSING VIRUSES.

VIRUS DISEASES, a group of infectious disorders of unknown etiology. It has not yet been possible,

either by macroscopic or microscopic studies, to bring convincing evidence of the presence of a causal organism in affected cells or tissues. The agents causing these diseases are apparently too small to be revealed by the best microscopes. Since they pass readily through porcelain filters that retain the smallest known bacteria they are frequently referred to as filterable viruses and are believed to be much smaller than bacteria. The only objects found in affected cells that even remotely resemble foreign organisms are plastic amoeboid structures known as inclusion bodies. The bodies may be either intranuclear or intracellular. They are far too large to pass the pores of bacterium-proof filters but it has been suggested that they may represent a stage in the life cycle of some very minute parasitic organism. The viruses are quite generally thought to belong to a group of ultramicroscopic bacteria or to some other very primitive form of life. The fact that they multiply and that they cause diseases that are similar in many respects to those due to living parasites seems to support this view. The belief that viruses are living organisms is not, however, shared by all students. Some consider them to be non-living and have suggested that they may be chemical substances somewhat similar to the enzymes.

Virus diseases affect man and animals as well as plants. Some well-known virus diseases of man are smallpox, measles, mumps and common colds. Rabies, hog cholera and the foot-and-mouth disease of cattle are examples of some of the most dreaded of the virus diseases of animals. Viruses cause a very large number of plant diseases. The mosaic disease of sugar cane, the curly top disease of sugar beets, the mosaic and leaf roll diseases of potato are examples of some important virus diseases of plants.

The immunization of animals for protection against virus diseases is a widely used means of control. Some methods in common use for the control of virus diseases of plants include the "roguing out" and destruction of affected plants when they are present among healthy ones, the control of insect vectors and the production or discovery of immune or highly resistant varieties which can be substituted for those that are susceptible.

L. O. K.

VIS, Italian Lissa, the ancient Issa, town on the Yugoslav island of the same name, the most westerly of the Dalmatian archipelago, with fine views of the east coast of Italy. Six miles from Comisa on the south of the island is the little island Busi with two blue grottos like those of Capri Island. Pop. 1921, 5,139.

VISAGRAPH, a machine which enables the blind to read any printed book, transcribing ordinary ink print into raised letters on an aluminum foil. The machine consists of two parts—a transmitter and a printer. The transmitter reads the book and transmits its impulses to the printer by means of six light beams, arranged in a vertical row along the printed line. Each beam is an exploring feeler for one of six printing bars, and when a beam strikes the black part of a printed letter it energizes the corresponding

printing bar. The bar then strikes from below, imprinting a line on aluminum foil and these lines form the raised letters. Readers of Braille or other raised letters can use the Visagraph with very little training, and printed matter in any language can be reproduced. The record on the aluminum foil can be preserved or smoothed out and the foil used again.

VISALIA, a city in southern California, county seat of Tulare Co., situated 43 mi. southeast of Fresno, served by buses and two railroads. There is an airport. The countryside is a highly productive irrigated region, producing citrus and deciduous fruits, cotton, cattle and dairy products. Visalia is a trade center, and has fruit canneries. It was founded about 1850, incorporated as the county seat in 1864, and reincorporated in 1874. Twice it has been visited by serious floods (1862, 1906), as well as by several droughts, causing heavy losses. Near by was the scene of the Mussel Slough tragedy, a battle between the early settlers and the United States Marshal and his men over railroad property (May 11, 1880). Sequoia National Park is a short distance east. Pop. 1920, 5,753; 1930, 7,263.

VISCACHA, a large rodent of the chinchilla family (*Chinchillidae*), inhabiting the plains of Argentina. It is almost twice the size of the North American prairie dog, which it resembles in its manner of life, but has a more rabbit-like form. In color it is grayish, with strong black-and-white markings about the head. Formerly viscachas were excessively numerous on the plains south of Brazil, living in companies of 20 or 30, and digging deep, complicated burrows, indicated on the surface by crater-like hillocks, around which the ground was made bare. The damage to pasturage and farming was so extensive that these animals have been greatly reduced in numbers. A small owl and several lesser birds make use of abandoned hillocks, as also do foxes and snakes. When excited the viscacha performs many curious antics, striking the ground noisily with its tail, the under side of which is thick and horny, and uttering a variety of queer cries. E. I.

VISCOSE SILK, commonly called rayon, is manufactured by a process discovered by Cross in 1891, but the process was not commercialized until 1901, and was first used in America in 1911. This process now accounts for about 88% of the world's synthetic yarn production.

In the viscose process cotton linters and wood pulp, in the form of sheets, are treated with sodium hydroxide solution to form soda-cellulose. The excess of solution is removed, the sheets disintegrated, and the "crumbs" matured. The crumbs are treated with carbon disulphide to form sodium cellulose xanthogenate which is dissolved to give the "viscose" spinning solution. After filtration and deaeration, the viscose is forced through spinnerets containing many small holes into an acid coagulating bath, which regenerates the CELLULOSE in the form of many fine filaments. The filaments from each spinneret are collected and twisted together to form the yarn. The

acid is removed by washing, the yarn wound into skein form for desulphurizing with sodium sulphide solution, bleaching, acidifying, washing, and oiling. After inspection and sorting, it is wound onto packages for shipment and use. The final yarn consists of regenerated cellulose. Its dyeing, chemical and other properties, except appearance, closely resemble those of cotton or mercerized cotton. See also YARNS, SYNTHETIC. C. E. M.

VISCOSITY, that property of a fluid which produces so-called friction between particles or layers of the fluid when they move relative to one another. In lubricants, the "body" is due to that property. Relative motion between infinitely thin layers of a liquid is set up when it flows through a small-diameter pipe; when it separates two plates or cylindrical surfaces, as a bearing and journal, which are in relative motion; when internal currents exist; and when a body, as a steel ball, moves through the fluid.

The viscosity of liquids varies with temperature and pressure, decreasing with the former and increasing with the latter; water is an exception to the viscosity-pressure rule. These variations are different for different liquids and there are no formulae which will cover them in all cases. The viscosity ordinarily decreases rapidly with temperature increments at low temperatures, but much less rapidly at higher temperatures. With pressure increases, the viscosity increases slowly at first and then much more rapidly, and it may attain enormous values at high pressures.

Poiseuille, in 1842, found that the volume of liquid that will pass through a capillary tube in unit time was proportional to the pressure on the liquid and to the fourth power of the radius of the tube and inversely proportional to the length of the tube. From these relations is written Poiseuille's formula

$$V = \frac{\pi R^4 P}{8 \mu L}$$

where V is the volume in cubic centimeters, P the pressure, R the radius, L the length and μ the coefficient of viscosity. The coefficient of viscosity is expressed in c.g.s. units (see PHYSICAL UNITS) and the coefficient, $\mu = 1.000$ is called a *poise*, one-hundredth of that unit being a *centipoise*.

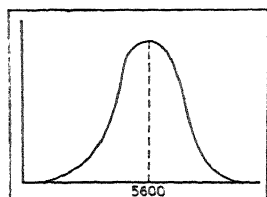
In experiments carried out by Rodger and Thorpe in an attempt to establish the relation between the viscosity and chemical structure of a liquid, it was found that the viscosity increased more or less regularly with the molecular weight in a homologous series. Liquids, such as alcohols, which consist of complex molecules show irregularities in this relation.

In the case of gases, the viscosity increases rapidly with temperature and is independent of pressure. For a discussion of the viscosity of solids see ELASTICITY.

For comparative purposes it may be mentioned that the coefficients of viscosity for water and atmospheric air at 0°C. are, respectively, 1.7921 and 0.01719 centipoise.

VISCOSITY TESTS. See ASPHALT TESTING; TAR TESTING.

VISIBILITY, a measure of the transparency of air, or an equivalent medium, to the light traveling from objects to the EYE. It is decreased chiefly by the absorption or scattering of light by particles of dust and moisture in the air (see **ABSORPTION OF LIGHT**; **DIFFUSION**). Starting with a very low intensity of light, the visibility increases as the intensity increases. As for most physiological effects, the apparent brightness of a body increases less slowly than the actual



VISIBILITY CURVE

Maximum visibility is in the green portion of the spectrum at a wave-length of 5,600 Angstrom Units

brightness, and probably follows a logarithmic relation. The visibility of any object also depends on the contrast between it and its background.

Visibility is quite different for different parts of the SPECTRUM, as shown in the curve by Ives, in which the abscissae are WAVE-LENGTHS and the ordinates are the apparent luminosities for equal intensities (see figure). The maximum sensitivity of the eye, or the maximum visibility, is in the green portion of the spectrum. See also **VISION**.

P. I. W.

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VISIGOTHS. See **GOTHS**.

VISION, the act of seeing, or the perception by the visual centers of the brain of the surrounding world as transmitted by the eye. The three main phases of vision are form, color, and depth. Rays of light from any luminous body, such as the sun or a lamp, strike an object and are reflected from that object to the eye. In passing through the transparent portions of the eye, they are bent and are brought to a focus upon the lining membrane of the eye chamber, the retina. The light stimulates certain cells in the retina, causing a nerve impulse, which passes along the fibers of the optic nerve to the hindermost portion of the brain, the occipital lobes, where lie the areas of perception. Colored light stimulates only certain cells in the retina and consequently arouses certain definite perceptions varying with the color, and varying from those aroused by white light. The color range over which the normal eye is sensitive is from the red of the solar spectrum to the violet. Depth perception is a function of the simultaneous perception of the same object by both eyes, plus the co-ordination of that binocular perception by a given center in the brain.

For the sake of registration of the degree of form vision, a more or less arbitrary method has been universally adopted by the ophthalmological profession. The eye is asked to discern at twenty feet a letter of such size that the rays of light coming from the extremities of the letter subtend an angle upon the retina of five minutes and each arm of the letter subtends an angle of one minute. Such vision is known as 20:20. If the eye at twenty feet can discern only the letter that should be discerned at forty feet, the vision is recorded as 20:40. The same standard is

applied to near vision, the distance here used being fourteen inches and the normal being known as 14:14. See also **COLOR-BLINDNESS**; **EYE**; **EYE, AFFECTIONS OF**; **SPECTACLES**.

H. S. G.

The sensation produced by light is not proportional to the intensity of light, but increases much more slowly for strong intensities, following approximately a logarithmic curve. When an impression has been made upon the eye, the effect persists for about 1/20 sec., giving rise to the phenomenon of persistence of vision, which makes possible the smooth appearance of rapidly changing views, such as moving pictures.

While no completely satisfactory theory of vision has as yet been reached, strong evidence supports the theory that the eye possesses two separate mechanisms for vision, represented on the retina by the presence of a large number of small elements called *cones*, interspaced with elements called *rods*. The cones are sensitive to light without producing the sensation of COLOR, and the rods, which are probably a later product of evolution, are sensitive to color. The color sensation can best be explained by the Young-Helmholtz color theory, according to which an eye possesses three sets of nerves, especially sensitive respectively to red, yellow and blue. The actual color sensation depends on the relative excitation of these three sets of nerves. In some individuals, one or more of these nerves may be inactive, so that color-blindness, for one or more colors results. See also **VISIBILITY**.

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VISION OF SIR LAUNFAL, THE, an allegorical poem by JAMES RUSSELL LOWELL, drawn from the Arthurian legend. After years of fruitless wandering over all the world, Sir Launfal turns homeward from his quest of the Holy Grail. As he reaches the gates of his castle he sees crouching there a hideous leper, begging alms. Sharing his last moldy crust with the repulsive creature, he beholds the leper transformed by a miracle into Christ, and his wooden bowl into the Holy Grail. This is the vision of Sir Launfal, dreamt on the eve of his setting forth on the quest. The poem was published in 1848.

VISIT AND SEARCH. The law of war accords a belligerent power the right to capture enemy property and seize CONTRABAND of war at sea en route to an enemy destination. Incidental to this right and to render it effective maritime belligerents are possessed of the right to visit and search merchant vessels at sea to determine whether they are enemy or neutral in character, and if neutral whether they are carrying contraband of war, attempting to break blockade or are engaged in rendering other unneutral service to the enemy. The right may be exercised upon the high seas or in the territorial waters of either belligerent.

E. A. K.

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VISITATION, ORDER OF THE (Nuns of the Visitation of Mary, or Visitandines), a cloistered contemplative order founded in 1610 at Annecy,

France, by St. Francis de Sales and St. Jeanne de Chantal, as a simple congregation active in the visitation of the sick poor. The institute was especially intended for those attracted to the religious life but unable to bear the rigors of corporal mortifications. In 1618 it became a religious order under the Augustinian Rule, with Constitutions by the founder, thereby relinquishing the external apostolate. But it has been frequently called upon for educational work, and maintains several convent schools, of which the academy at Georgetown, D.C., is a distinguished example. St. Margaret Mary Alacoque was a Visitation nun. Each community is autonomous under episcopal jurisdiction; Annecy, cradle of the order, is consulted on doubtful points of observance. A total of approximately 7,000 religious includes choir nuns, associate nuns and lay sisters. There are about 260 Visitation convents located in Europe, England, Canada, the United States and Latin America.

VISTULA, Weichsel, German; Wisla, Polish, one of the chief rivers of the central European plain. It rises in the mountainous regions of northern Czechoslovakia, crosses into Poland, traverses much of that country, passing through such centers as Warsaw and Krakow and pursues its course along the east Prussian frontier, flowing west and north to enter the Baltic Sea near the free city of Danzig. The Vistula's affluents are unimportant. The river is icebound during three months of the year and is subject to periodic floods. To make this 630 mi. waterway navigable and therefore commercially important, constant improvement is necessary; and since international controversy over its ownership has raged since the World War, little has been accomplished and there is practically no river traffic above Warsaw, although quantities of timber float down the river.

VITALIAN, ST., Pope, 657-672. He adapted himself to the Monothelite opposition of Emperor Constans II. See **MONOTHELITES**.

VITALIS, ORDERICUS (1075-c. 1143), historian, was born at Atcham, England in 1075. He was sent while very young to become a monk at St. Evroul, where most of his life was spent. Vitalis is one of the most important chroniclers of his century, being occupied after 1120 with writing a *Historia Ecclesiastica* in 13 books. His information is gathered from the pilgrims, knights and other persons who visited the monastery. Begun as a history of the monastery his work was expanded into a universal chronicle, chiefly concerned with England, France and Norman Italy. It is particularly important as a source for the history of the sons of **WILLIAM THE CONQUEROR**. Ordericus has been criticised for his style and the structure of his work but his narrative has a vivid quality unusual among medieval historians.

VITALISM. Theories attempting to explain life processes by special vital forces neither exhibited by inorganic matter nor capable of physico-chemical interpretation, are vitalistic. Adopting a mechanistic explanation of many life processes, vitalists freely

admit that the principle of leverage applies to the bones and muscles of a man's arm, that one's back teeth grind like a mill, that the saliva chemically changes starch to sugar, but, following Aristotle, they may assume that a man's mind and his development from egg and embryo are directed by superphysical "entelechies." They may agree with Bergson that an "élan vital" directs evolution toward purposeful ends.

To the vitalist, as to the idealist, the idea in nature precedes its realization; to the mechanist the idea is a result, i.e., the bird's wing, as an organ of flight, is merely the outcome of numerous chemico-physical and biological events that by a trial-and-error process, like natural selection, have yielded this result.

An intermediate point of view now widely held is emergent evolution, or organicism. The mechanistic standpoint is assumed, but with reservations. In organisms, situations and processes appear which are much too complex to be explained as yet in terms of chemico-physical motions of molecules and electrons. They are peculiar to life, yet strictly subject to natural law. J. H. G.

VITAMIN, name applied to one of a group of substances found in certain natural foods, the exclusion of which from the daily diet results in nutritional failure and disease. The chemical structure and composition of vitamins remain unknown. However, as important dietary factors and necessities of a health promoting diet, they rank with carbohydrates, proteins, fats, mineral salts and water. The dietary need for vitamins was first brought to the attention of scientists by reports of the ill effects resulting from a lack of fresh food in the diet of sailors. Before 1800 the prevalence of scurvy had been noted in the British navy, and the condition was corrected by the addition of fresh lemon juice to the daily ration. Until 1885 many fatalities had occurred regularly among the sailors of the Japanese navy from a disease called beriberi, but when barley was substituted for polished rice, which had been the main source of food supply, the symptoms of the disease disappeared entirely.

Casimir Funk, in 1911, first used the term "vitamin" to describe the substance whose presence in the diet prevents the occurrence of beriberi in man. In his experiments Funk used the same method that he employed in separating organic bases of the type called "amines." He coined the new term by prefixing the Latin *vita*, meaning life-amine. Later the name became misleading because it was discovered that all vitamins do not have the nitrogenous properties of amines. However, in order to retain a name already in general use, only a slight change was made by discarding the final *e*.

In the demonstration of the identification of the different vitamins, white rats and other animals were used in experimental feeding. During the experimental process, the daily ration of all animals included the food elements of carbohydrate, protein, fat, mineral salts and water, these having been carefully weighed and tabulated. However, there was intentional varia-

tion in the source of supply of these elements, such as a substitution of butterfat for vegetable oil, or dried vegetables for fresh ones. By continued and patient observation and tabulation of results, conclusions were reached as to the absence or presence of an additional food factor.

For the classification of vitamins as found in foods, see article **VITAMINS IN FOODS**.

For diseases due to lack of the necessary vitamins in food, see **VITAMIN DEFICIENCY DISEASES**. S. S.

VITAMIN DEFICIENCY DISEASES. The value of vitamins in the prevention of disease (see **VITAMIN**) has been tested by experimentation. Thus it was proved that certain vitamins were specific in the cure or prevention of certain diseases. The facts established were as follows:

The most serious effect produced by the lack of *vitamin A* in the diet is the retarding of *growth* in the animal. A child whose diet does not provide this vitamin in sufficient quantities is stunted, undeveloped and susceptible to infections of all kinds. Due to this susceptibility a wide range of physical disorders results. Most frequently the eye is attacked by a disease known as xerophthalmia or keratomalacia, which is completely cured on the addition of vitamin A to the diet. Not only the eyes, but all organs are rendered more sensitive to infections when this vitamin is omitted from the diet.

TABLE OF VITAMINS

VITAMIN	KNOWN FUNCTION	CHIEF SOURCES
A	Growth promoting Aids in prevention of infections	Butter, cream, milk, egg yolk, green leafy vegetables, yellow pigmented vegetables, animal organs, cod liver oil
B ₁ (or F) B ₂ (or G)	Prevents beriberi Aids in prevention of pellagra	Whole grain cereals, egg yolk, animal organs, green leafy vegetables, milk
C	Prevents scurvy Thought to prevent dental decay	
D	Prevents rickets	Cod liver oil, egg yolk, butter, yeast
E	Prevents sterility in animals	Whole cereals, egg yolk, lettuce, fresh meats

The deficiency of *vitamin B₁* caused the disease which attacked the sailors in the Japanese navy and which was found to be *beriberi*. When polished rice was replaced by barley a corrective effect was produced at once. Had the whole rice kernel been substituted for polished rice the result would have been equally good, as the outer covering or hull of all grains contains vitamin B. If this disease attacks fowl, it is known as polyneuritis. Certain authorities claim that the action of vitamin B is connected with the endocrine glands and other more indefinite physiologic functions. Whether **PELLAGRA**, similar to both scurvy and beriberi, is a deficiency disease or an infectious disease is still the subject of controversy. However, it appears most frequently in poorly nour-

ished groups (in parts of Italy, Spain and southern United States), which has led to the belief that faulty diet is one of the contributing factors. Originally it was assumed that vitamin B was composed of two active principles, one of which was essential to the prevention of beriberi, the other a pellagra preventive. In an attempt to differentiate them, the anti-neuritic factor has been termed B₁ (or F) and the pellagra-preventive designated as B₂ (or PP or G). Treatment of pellagra by a mixed diet rich in vitamin B usually results in recovery, but this is not invariably true. Therefore, the whole subject of this vitamin is still a matter of speculation and leaves a fertile field for further investigation.

Lack of *vitamin C* produces *scurvy*, the symptoms of which are hemorrhages, fragility of bones and general malaise. But, like the other two vitamins previously mentioned, many degrees of ill-health may result from insufficient quantities in the diet. In fact, the scurvy which attacked the British navy is now a rarity, but atypical (non-typical), related conditions are common to-day in less serious forms. Misers and recluses who eat abnormally sometimes present pictures suggestive of this disease. Deficiency in this vitamin leads to malformation and decay in the teeth of animals of all ages. To insure proper development, it is necessary that the pre-natal diet of the mother be rich in C, and that the supply be adequate throughout the lifetime of the individual.

Lack of *vitamin D* results in the failure of the normal calcification of the bone, which is accompanied by a disturbance of the calcium-phosphorus equilibrium of the body. This abnormal condition is known as *rickets*. The prevention and cure of rickets is brought about by the combination of two factors, sunlight and a diet rich in vitamin D. The action of one or both is not completely understood as yet, but rickets can be cured by the administration of either one alone if supplied in sufficient quantities. Usually treatment includes both of these factors to insure a speedier result.

As distinct from all the other vitamins, it has been proved that the exclusion of *vitamin E* from the diet produced sterility in animals, and the introduction of food containing this vitamin will restore fertility.

Conclusions. The subject of vitamins is as yet an unfinished chapter in food research. The discovery of the chemical nature of these mysterious rejuvenators will forge an important link in the chain of facts surrounding them. Thus far it has been conclusively demonstrated that the human diet cannot be restricted to dried and highly refined foods without disastrous results to the health of the individual. Not only scurvy, beriberi and rickets result from a deficiency of vitamins in the diet, but continued exclusion of vitamins may produce many vague, borderline states of ill-health.

In times when the nutritional needs of a large group of people suffer, because of poverty or a disturbance of the food supply, evidences of ill-health occur which apparently can be traced to the lack of something in

the diet. This deficiency is not necessarily in vitamins, as a lack of proper balance of the other food elements also causes nutritional disturbances. Even on what is quantitatively an adequate normal diet, starvation in certain essentials may occur and the individual may suffer. As yet science is not far enough advanced always to find the exact cause. Vitamin deficiency, protein deficiency, unbalanced diets cannot always be definitely placed in relation to indefinite signs of illness.

The so-called normal diet is a simple one, consisting of a palatable mixture of common foodstuffs. In fact, it is the typical diet of a prosperous community under normal conditions. It will naturally include foods rich in vitamins, namely fresh fruits, whole cereals, raw vegetables and dairy products. It will also supply an adequate amount of protein and mineral salts, and will meet the average daily fuel requirement. To be specific, all of man's nutritional needs will be met if he will plan his daily diet as suggested by E. V. McCollum, to include: one quart of milk per day, two fresh salads, two servings of leafy green vegetables, one serving of meat, and liberal quantities of butter, fruit, cereals, bread and water. *See also* DIET AND DIETETICS. S.S.

VITAMINS IN FOODS. Six vitamins are now recognized as essential constituents of human food. These are designated as vitamins A, B (B_1), C, D, E, and G (B_2). (The designation F has been temporarily used in two or three different senses and is not now in general use.) Vitamins A, D and E are fat-soluble; vitamins B, C and G are water-soluble. The system of designating the vitamins by letters is colorless—it does not reflect the dramatic interest attaching to these substances as specific preventives of deficiency diseases—but it has the advantage of avoiding the very real danger that a more physiological designation might be found, as knowledge grows, to have put the emphasis in the wrong place. Leaving the discussion of vitamins and their connection with disease to the article on VITAMIN DEFICIENCY DISEASES, the present article will deal with the vitamins rather as factors in normal nutrition and in the nutritive values of foods.

Vitamin A was discovered in 1913, independently by McCollum and Davis and by Osborne and Mendel, through experiments in which it was found that animals on food-mixtures alike in other respects would grow and thrive or would sooner or later cease to grow and fail in health according as the fat in their food was butterfat or lard. And soon it was found that egg fat and cod liver oil resemble butter in this respect, while most commercial fats resemble lard. That growth and health may continue for a time upon food lacking this vitamin, is due to the fact that the body can store it for future use. The cod (partly because he has so little fat anywhere in his body) stores a relatively high concentration of vitamin A in his liver. The livers of animals generally contain more of this vitamin than do their other tissues. Its concentration in milk and eggs, the materials evolved by

nature for the transfer of nutritional essentials from the mother to the young, is a significant hint as to its great importance. It is now recognized as an extremely important factor in food value.

The foods most important for their vitamin A values are milk, and all of its products which contain the milk fat; eggs, in which practically all of the vitamin A is contained in the yolk; liver, when the animal has been so fed that there has been a surplus of vitamin A for storage; and the green and yellow vegetables and fruits. The vitamin A values of the vegetables and fruits are believed to be due not, strictly speaking, to the presence of vitamin A itself but rather of certain plant pigments which are converted into vitamin A in the animal body. One of the great services of the milch cow to man is in consuming large quantities of grasses and other plant products too coarse for convenient human consumption, and bringing their vitamin A values into easily assimilable form in the fat of her milk.

Vitamin B is the antineuritic substance which prevents the disease beriberi, and which has also been found to have important functions in normal nutrition. It occurs in significant amounts in nearly all food of both plant and animal origin if these have not been artificially and unduly refined. Such choice of foods as will provide ample supplies of both vitamins A and C, which are not so widely abundant, may generally be trusted to provide an ample supply of vitamin B also. The germs (embryos) of the grains are relatively rich in vitamin B and at the time this is written (1932) they are apparently being made more generally available for use as human food in those cases in which such enrichment with vitamin B is desired.

Vitamin C, originally known as the substance which prevents scurvy, is now recognized as important in normal nutrition and in the everyday consideration of food values. Among the foods richest in vitamin C are raw cabbage, grape fruit (fresh or canned), lemons, oranges, and tomatoes (fresh or canned). Apples, bananas, peaches, pineapples and doubtless several other fruits and vegetables might be grouped as occupying a second rank of richness in vitamin C. Milk and cooked potatoes are foods which contain this vitamin in lesser concentration but may be among the most important sources because of the larger amounts in which they may well enter into the dietary.

Vitamin D (abundant in COD LIVER OIL) has been found in significant amounts in egg yolks, milk and butter and probably would be detected in a wide variety of foods if looked for by sufficiently delicate methods; but the commercial development of irradiation processes for the artificial production of vitamin D deflects interest from its natural occurrence in foods.

Vitamin E seems to be so generally present in natural foods as not to demand the development of methods for the measurement of its relative amounts.

Vitamin G is now recognized as a very important factor in food values, whether or not it is the distinctive pellagra-preventive substance that some have

thought. Milk and eggs are known to be excellent sources of vitamin G. Meats and fish are probably also good sources. Among vegetable food not many quantitative comparisons have yet been made, but the leaves seem to be relatively richer in vitamin G than the seeds, and the green and yellow plant tissues richer than those which are colorless.

In general our present knowledge of the vitamin values of food lends emphasis to the view that vegetables and especially milk and its products may well be given a larger place in our dietaries and food budgets. (See also DIET AND DIETETICS.) H. C. S.

VITEBSK, an important town in the northeastern part of the White Russian S.S.R., and a progressive trading center. The Annunciation Church dates from the 11th century, other distinctive edifices being two beautiful cathedrals and a museum. Notable among its industrial enterprises are agricultural machinery and implements works, flax spinning plants, and a large spectacle factory. Glass, shoes, needles and bristles are other products. Vitebsk dates from an early period in Russian history. It belonged to Lithuania in the 14th century, to Poland in the 16th century and was annexed by Russia in 1772. Before it was annexed it was leveled by fire three times. Pop. 1926, 98,808.

VITERBO, a town and episcopal see of central Italy, situated about 55 mi. northwest of Rome. The town was included in the grant made by Matilda of Tuscany to the Papal see in the 12th century. It is surrounded by walls and towers built by the Longobards. Among the interesting churches are those of San Francesco, Santa Maria della Salute and Santa Rosa. The 13th-century municipal palace is now a museum. The Romanesque cathedral was built probably in the 12th century. Pop. 1931, 37,059.

VITHARR or **VIDHARR**, in Scandinavian mythology, one of the **Æsir**, son of **Odin** and **Frigg**. He was the god of silence.

VITORIA, a city of Spain, capital of the province of Alava, and the seat of a bishop. The old city is surrounded by walls, and the present city has a fine square with colonnades, handsome parks, a Gothic cathedral built in 1181, and restored in the 14th century, former cloisters, palace of the provincial diet, city hall, several educational institutions and a large provincial library. Archives for Basque folklore were established in 1921, a department for prehistoric research in 1925, one for science in 1925, and also an ethnological laboratory. The chief products are leather goods, pottery, candles, paper, soap, wine, horses, mules and furniture. Est. pop. 1929, 35,000.

VITRIOL, a name applied to certain chemical salts, usually sulphates. Thus, blue vitriol is used as a common name for copper sulphate or **COPPERAS**; green vitriol for ferrous sulphate; white or zinc vitriol for zinc sulphate; oil of vitriol for sulphuric acid. The term "vitriolate of" a metal is generally taken as synonymous with "sulphate of" that metal. Vitriols are commonly characterized by a glassy or lustrous appearance.

VITRUVIUS (Marcus Vitruvius Pollio), Roman architect and engineer, was born at Verona about a century B.C. He was employed as military engineer in Africa by Julius Caesar in 46 B.C., and during Augustus' reign was inspector of engines of war. He designed a temple at Fanum, and his "De architectura," the only surviving Roman treatise on architecture, is said to have strongly influenced the early theory and practice of Renaissance and pseudo-classical architecture.

VITUS, ST., Christian martyr and patron saint of Bohemia and of Saxony, was born in Sicily of noble parents in the 4th century. The purely legendary accounts of this saint during the persecutions under the Emperor Diocletian report that he was martyred at Rome about 302. For some unknown reason St. Vitus came to be regarded as the saint to invoke in cases of epilepsy and especially of the sickness that has come to be known as St. Vitus's Dance. St. Vitus's Day is celebrated on June 15.

VIVEKANANDA (1863-1902), Indian religious leader, born at Calcutta, Jan. 12, 1863, and died at Belur on July 4, 1902. His real name was Narendranath Dutt; the name Vivekananda being given him shortly before his trip to the United States in 1893. He came of a great aristocratic family belonging to the Kshattri or warrior caste and both his mother and his father showed remarkable independence of intellect and spirit. He himself was physically and intellectually extraordinarily well equipped, and as a boy he received an exceptionally broad education. In 1880, while he was a university student, he first came into contact with **RAMAKRISHNA**, by whom he was very greatly impressed. At the time he was an avowed atheist, but Ramakrishna made much of the young man in whom he saw the possibility of a great religious leader. In 1884 his father died, and Vivekananda found himself virtually penniless. After some months of emotional turmoil, he turned definitely to religious faith, and from that time on until his death he moved rapidly forward to a place of prominent leadership in the social and religious ferment of reconstruction which was going on in India. In 1893 he visited the United States to attend the Congress of Religions at the Chicago World's Fair, and made a profound impression on all with whom he came in contact.

VIVIANI, RENÉ (1863-1925), French statesman, was born Nov. 8, 1863 at Sidi-bel-Abbes, Algeria. A successful lawyer and popular leader of the Socialist party, he was elected Deputy for Paris. Viviani left the party in 1904, simultaneously with Briand, but remained an Independent Socialist, was reelected in 1906, and accepted in the same year the portfolio of Minister of Labor in Clémenceau's Cabinet. Later he became Minister of Public Instruction, and in 1914 Prime Minister working in close cooperation with President Poincaré. Upon the overthrow of his ministry in 1915 he entered the Briand government as Minister of Justice. He visited the United States during the World War, and again in 1921 when

he represented France at the Washington Disarmament Conference. He died at Ciamart, Sept. 7, 1925.

VIVISECTION. Experimentation on living animals has been largely responsible for the development of modern scientific medical knowledge. It was used by William Harvey in discovering the circulation of the blood; with its aid, Pasteur founded the science of bacteriology. Without it, such diseases as hydrophobia, tuberculosis, yellow fever, plague, scarlet fever, diphtheria and diabetes would not have come under the control of scientific medicine. Without it, it would be impossible to prepare any of the serums or antitoxins used in the control of infectious diseases. Before the discovery of the serum for epidemic meningitis, from 50 to 75% of those who were afflicted died. When the serum is given, the mortality is below 25% of those affected, not to mention the saving in illness and in permanent disability. In the investigations which led to this discovery, rabbits, guinea-pigs, horses and monkeys were used.

Most of the potent drug remedies used to-day must be tested and standardized by the use of animals. Most of our important synthetic drugs were first evolved by the use of animals. The lower animals have benefited as much as man through progress made in animal experimentation. Hog cholera serum, the tuberculin test for cattle, the control of foot-and-mouth disease, puerperal sepsis in cattle, hydrophobia, fowl plague and the many worm diseases that afflict the animals depend for their control upon the same type of experimentation that has yielded results for the diseases of man.

Scientific experimentation on animals began to attract public notice about 1875. In Great Britain, agitation resulted in the appointment of a royal commission which made an investigation and recommended that the work be continued under suitable control. Since that time, groups of people organized as anti-vivisection organizations have agitated for legislation against animal experimentation. Their official publication in the United States is called *Our Dumb Animals*. In Great Britain it is called *Abolitionist*.

It is impossible to list the tremendous number of discoveries in medical science that have been made through the use of animal experimentation. Medical scientists have not waited for government or other supervision to establish control over animal experimentation that will make it as nearly perfect as possible in preventing unnecessary pain and in providing animals with the best of care. A committee of the American Medical Association regularly functions for no other purpose. Under the control of this committee each laboratory binds itself to observe the rules laid down and to post those rules regularly in each department. The rules require that animals be held, before using for experimentation, at least as long as they are held at the city pound; that they receive every consideration for their bodily comfort; that no operations be made, except with the sanction of the director of the laboratory; that animals be anesthetized

and rendered incapable of receiving pain in all operations, except in those in which anesthesia would defeat the object of the experiment, and finally that animals be killed painlessly at the conclusion of the experiment. These rules are most rigidly enforced and laboratories throughout the country are open to inspection by anyone interested from a scientific point of view, or from the point of view of control of this work.

M. F.

VIZETELLY, FRANK HORACE (1864-), American lexicographer, was born at London, Apr. 2, 1864, and educated in France and England. He located in New York City as assistant editor of the *Standard Dictionary*, of which he was appointed editor in 1913. He became editor of the "The Lexicographer's Easy Chair," in the *Literary Digest*, in 1912. His publications include *A Desk-Book of Errors in English*, *Essentials of English Speech*, *Dictionary of Simplified Spelling* and *Slips of Speech*. In lectures and some of his publications he has defended American pronunciation of English against the attacks of British critics.

VIZETELLY, HENRY RICHARD (1820-94), English publisher and author, was born in London, July 30, 1820. In his early years he studied wood-engraving. He edited various illustrated papers, chiefly in London, and in 1887 established a publishing house there. As a publisher he specialized in translations of Russian and French authors. Vizetelly's writings include *Paris in Peril*, written with his son, Ernest, *The Story of the Diamond Necklace*, *The Wines of the World* and *Glances Back Through Seventy Years*. He died Jan. 1, 1894, at Tilford, England.

VLAARDINGEN, a city in the Dutch province of South Holland, situated on the Nieuwe Maas. The city has a spacious harbor and is known chiefly for its herring fisheries. Pop. 1930, 27,842.

VLADIKAVKAZ, a mountain town in the North Caucasian Region of the R.S.F.S.R., situated at the foot of Mt. Kazbek, which is 2,345 ft. high. It is built on the Terek River, near the Dariel gorge. The site was chosen as a fort in 1784 to aid Russia in her struggles with the mountaineers, and for years Vladikavkaz was the capital of the North Caucasian Region. In 1864 a military road was put through the Caucasian Mountains connecting this city with Tiflis. Railways now follow this route and thus link North Caucasia with the Baku territory. The Terek River divides the city into two well-planned parts, further enhanced by beautiful parks and museums. A zinc, lead and silver-smelting plant is the leading industrial enterprise. Pop. 1926, 78,347.

VLADIMIR, an administrative center of the Vladimir district in the Ivanovo-Industrial Region of the R.S.F.S.R., and an important textile town. Its situation on the Kiazma River and on railways makes it a trading center between Moscow and Nizhni-Novgorod. Established as a walled town in 1108, Vladimir soon became the capital of all Russia. Tataric invasions and annexation to Muscovy diminished its glory. Vladimir's numerous Byzantine churches

have distinctive sculptured figures on the exteriors, typified in the 12th century Assumption Cathedral. Among the industrial enterprises are factories making knitted goods, fruit juices, building materials and other commodities. Pop. 1926, 38,566.

VLADIVOSTOK, principal seaport of the Far Eastern Region of the R.S.F.S.R., and its southernmost town. Located on the Muraviev Amursky Peninsula, on the northern and western shores of Golden Horn Bay, it is one of the finest harbors in the world. Significant both commercially and strategically, Vladivostok is one of the best-planned cities in the Far East and Siberia. Founded about 1860, it immediately became a valuable naval and commercial center; a fort was erected in 1869 and railway construction began in 1891. Revolution broke out there following the Russo-Japanese War in 1904. Foreign intervention followed the close of the World War and the town did not become Soviet territory until 1922. Vladivostok is the seat of the Far Eastern University. Lumber, tea, soy beans, coal, fish, salt, linseed and cereals are the principal items exported. The city has important ship-repair shops. Coal and silver in the neighboring territory, breeding grounds for reindeer and fisheries are further sources of wealth. Pop. 1926, 107,980.

VOCATIONAL GUIDANCE, both an educational movement and a clinical technique. The guidance point of view has developed out of the child study movement, the recognition of individual differences in psychology and remedial efforts to retrain rather than confine all forms of social maladjustments. Guidance as an educational movement is the product of the social thinking of the 20th century. Education and industry have come to recognize in the individual's motives and interests, as well as in his abilities, the essential criteria upon which to build an effective system of training. Education came first to see this through the philosophy of Herbart and Dewey. Industry has more recently come to recognize that what is of benefit to the individual is in the long run of advantage to industrial management. Today guidance is a part of the social philosophy of education and industry.

Vocational guidance involves educational guidance and often guidance of a very general sort. This work took definite form in 1908 when Frank Parsons established the Boston Vocational Bureau for the guidance of youth. The National Vocational Guidance Association developed out of this pioneer work in Boston. This association has for its purpose the maintaining of professional standards of training and ethics and the development of methods of work in the field of guidance. Today guidance workers are employed in social organizations, public school systems, private educational institutions, universities, prisons, industrial establishments and various bureaus for the social adjustment of the handicapped individuals. Their numbers run into the thousands.

Vocational guidance as a technique is based upon 1. Personality information, and 2. Occupational in-

formation. It uses psychological measurement to secure the personality information and job analysis to secure the occupational information.

Occupational descriptions were used by the early counselors in giving information of the occupations. More recently, job specifications have made available the measurement of requirements in terms of job skills and interests. The personnel office in an educational institution or industrial establishment has as one of its purposes the assembling of all possible sources of occupational information. The more this information can be stated in terms of measurable requirements upon personality the more useful it is in guidance. Developments in psychological measurement are offering standards of educational and occupational adjustment from which there is prediction of achievement and interests.

All of this is making vocational guidance very exact. But if overemphasized, the statistical point of view, using norms and chances of prediction, is likely to lead to serious errors. Leaders in the field of vocational guidance recommend a clinical technique which makes use of all available quantitative measures, but which combines with these measures the results of general observation. A case history showing trends of ability and interest development is often used. The educational or vocational recommendations should be based upon a thorough-going personality study.

Several working principles of vocational guidance are well established. 1. Vocational guidance is a genetic process of training, beginning early in life with general guidance, proceeding throughout education in the school system, entering into industry in the adjustment of the worker to the job, and having a place in social institutions concerned with the adjustment problems of adult life, even among those bordering upon mental abnormality. 2. Vocational guidance is based upon information of social, educational and occupational requirements, and information of mental abilities, interests, emotions and motives. 3. Guidance gives all the information—in so far as it can be understood—to the individual for his self-guidance.

The benefits of vocational guidance are in improved educational, industrial and social adjustment. It is believed that in so far as an improved adjustment of the individual is effected, the employer, the teacher and society will be benefited. D. F.

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VOCATIONAL SCHOOLS, a term used broadly to refer to all types of institutions which give specialized preparation directed to entrance on some occupational career. It does not include preparation given at the college and university for entrance to such professions as law, medicine, engineering, and others. It is generally considered undesirable to begin such specialization before the elements of a good general education have been acquired.

Vocational education in other countries than the United States is given in a great variety of full-time and part-time special schools. The second type is particularly widespread in Germany under regulations for compulsory attendance at continuation schools. Full-time schools of all grades varying in the duration of the courses from one to six years following primary education are provided in most countries, progressing from direct trade training as a complete or partial substitute for apprenticeship into training for vocations which require a solid basis in sciences and mathematics. In the United States, on the ground that such a practice is more democratic, vocational education is in the main given in the regular high schools, specialization being gradually introduced. Other types of vocational schools, full-time, part-time, and evening, are also to be found. The provision of vocational schools has been stimulated under the provisions of the Smith-Lever and Smith-Hopkins acts. See AGRICULTURAL EDUCATION; COMMERCIAL EDUCATION; INDUSTRIAL EDUCATION.

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VOGT, HANS (1890-), German inventor was born at Worlitz, Bavaria, Sept. 25, 1890. After a study of problems of telegraphy and earth currents, he turned to research in the field of high frequency electrical discharges. In 1918 he joined others in an association designed to discover a means of accompanying motion pictures with mechanically reproduced conversation. Sound waves produced by a speaker were transformed by means of a microphone into electrical pulsations which by means of a photoelectric cell were in turn replaced by light pulsations. These were photographed upon the film and the process reversed upon exhibition. The first public showing of this talking film was at Berlin, Sept. 17, 1922.

VOICE, a category of the verb which indicates whether the subject simply exists in the state or performs the action connoted by the verb, or whether he so exists or acts reflexively, reciprocally, or for his own profit ("they hate," "they hate themselves," "they hate one another," "they hate for themselves"), these voices being called active and middle. The latter survives in Indo-Iranian, Greek, Italic and Celtic, being termed deponent in the last two. For the most part, the middle is replaced by the passive, indicating that the action is performed on the subject ("they are hated"); but INDO-EUROPEAN had no distinct passive, middle and passive coinciding, even in Indo-Iranian and Greek, except in a very few forms of relatively late development. The exact point at which the passive was evolved from the middle is difficult to determine; it may have been the perfect (see ASPECT, TENSE); or it may have been from an impersonal use of the middle, cf. Latin *Rhenus citatus fertur*, "the Rhine flows (carries itself) swiftly," *dicitur*, "one says, it is said," *itur*, "one goes," this use being extended analogically from the third person to the two others. In certain languages, such as Dano-

Norwegian, Swedish, Baltic and Slavic, and sporadically elsewhere, e.g., French *il se trouve*, "it is found," the passive is replaced by the reflexive; and another substitute is formed by verbs meaning "to be," etc., plus the medio-passive past participle, either throughout (e.g., English "I am loved"; German *ich werde geliebt*), or in the perfect only (e.g., Latin *amatus sum*, "I have been loved," but *amor*, "I am loved"). Certain languages, as Basque, Caucasian, Modern Indian and Malay, tend to replace the active by the passive, with the type "the dog is seen by the man" = "the man sees the dog." See also separate articles on the above languages. L. H. G.

VOITURE, VINCENT (1598-1648), French poet, was born in Amiens in 1598. He was very popular in Paris society and brilliantly successful as a writer of light and graceful society verse. His poems and his personal letters were so witty that they were handed around Paris for perusal among a large circle of friends. Voiture was one of the earliest members of the French Academy. He died on May 26, 1648.

VOIVODA (Slavic *voivoda*, *vojvoda* "general"), the title of the former elective ruling princes of certain southeastern-European areas, such as the Banat, Transylvania, Moldavia, and Wallachia. In modern Poland the title is now applied to provincial governors.

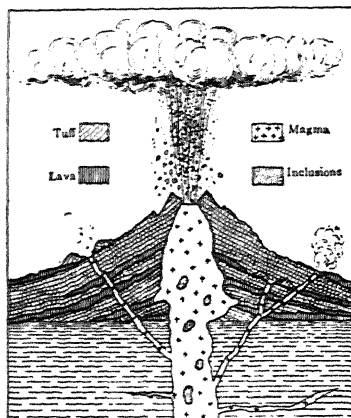
VOLANS (gen. *Volantis*), the flying fish, a small constellation of faint stars between Carina and the south pole of the heavens. See STAR: map.

VOLAPÜK, an INTERNATIONAL LANGUAGE invented in 1879 by Father (later Monsignor J. M. Schleyer, In formation it is partly arbitrary and partly based on existing languages, with a declension of four cases and a complicated and rich conjugation with personal pronouns postfixed to the verb-stem. Its phonology is based on German, and much of its vocabulary on English, but so changed that the words become unrecognizable. Derivatives are formed by means of an extensive system of affixes. For a few years Volapük had a relatively large number of adherents, but its difficulty, complicated by dissensions among Volapükists, led to its replacement by a new language proposed principally by a Russian engineer, W. Rosenberger, in 1893 and called Idiom Neutral. This was built upon the theory that root-words and affixes should be chosen from those most obvious internationally; but though it was reformed a few years later, it has practically disappeared in favor of LATINO SINE FLEXIONE. H. S. E.

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VOLATILITY, the quality of a material indicating the ability of the material to vaporize or the degree to which it will vaporize at ordinary temperature and pressure—as on exposure to the air. With particular reference to motor fuels, such as gasoline, volatility is defined quantitatively as the percentage by weight which is vaporized under fixed conditions of temperature, pressure and air-fuel ratio.

VOLCANISM, spelled also vulcanism, refers to the whole series of phenomena associated with the activity of **VOLCANOES**. This includes not only the explosive types of eruptions, and the quiet ones, but other less manifest accompaniments of the extrusion of molten rock at the earth's surface. When a local portion of the sub-crustal part of the earth, in the **ASTHENOSPHERE**, becomes sufficiently superheated to melt, the pressure of surrounding parts pushes the molten mass, or **MAGMA**, upwards. If this succeeds in reaching the surface before solidifying as an igneous intrusion, a volcanic eruption results. On its way, however, the heat of the magma and the solutions it gives off, meta-



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HYPOTHETICAL CROSS SECTION OF A
VOLCANO

Various phases of volcanism are shown, the intrusion of underlying rocks by the rising magma, the successive surface flows of lava, and the intervening deposition of fragmental material or tuff. Lava and tuff together build up the volcanic cone or mountain.

morphose or alter the rocks nearby. If there are zones of weakness in the neighboring formations, tongues of molten material may force their way in, to solidify as **DIKES**, **SILLS** and other igneous bodies. Vents may form near the volcano from which hot vapors and gases issue, which also exert metamorphic effects on the rocks through which they pass. Deposition of ore minerals may accompany these activities.

As the heat of the molten magma is dissipated, volcanic activity dies down, to give place successively to **FUMAROLES**, **GEYSERS** and cold mineral springs. See also **GEOLOGY**; **IGNEOUS ROCKS**; **METAMORPHISM**; **ORE DEPOSITS**; **PETROLOGY**.

VOLCANO, an opening in the crust of the earth from which is forced steam and lava; also a mountain or hill mostly formed of the material which issues forth. This eminence is generally conical in shape, with a crater at the summit. Volcanoes are "active" when in eruption, "dormant" when a long time has passed since last activity, and "extinct" when it is known that eruptions have totally ceased. Though occurring in various widely separated regions, as Iceland, Italy and the West Indies, volcanoes are most numerous in mountain systems bordering the shores

of the Pacific Ocean, as in South America, Alaska and Japan. In the continental United States Lassen Peak, California, which erupted in 1914, is the only volcano active in recent years. Among well-known active volcanoes are **VESUVIUS**, **COTOPAXI**, **ETNA**, **Hecla**, **Katmai**, **Colima**, **Stromboli**, and **Mauna Loa**. The list of dormant and extinct volcanoes includes many notable mountains, as **Aconcagua**, **Chimborazo**, **Elbruz**, **Orizaba**, **Popocatepetl**, **RAINIER** and **SHASTA**.

VOLE, a mouse of the group *Microti* of the sub-family *Microtinae*. Voles are typically small, rather clumsy, short-tailed mice with a tendency to aquatic habits. The American meadow-mouse and the British vole are good examples. Included in this group are the American muskrats, and the red-backed mice.

VOLGA, the longest European river and most important Russian waterway. It is 2,300 mi. long, and drains an area of more than 560,000 sq. mi. "Mother Volga" has seen the migrations and invasions of many peoples, Huns, Khazars, Bulgars; Finns from the north, Turks from the south, Mongols and Slavs.

It has its source amidst the lakes of the Valdai plateau, and becomes a good-sized river as it emerges from Lake Volga. Many tributaries join it, the first large one being the Selizharovka. Flowing east to Nizhni-Novgorod, the Volga united with the great Oka, itself 1,000 mi. long, which for centuries served as a frontier between Slavs and Tartars. Continuing east, it receives the Kama and then surges on south and southeast, ever becoming mightier as its confluence with other streams takes place. Near Stalin-grad it is only 45 mi. from the Don, and estimates for a canal to connect the two waterways were accepted in 1928. Finally the Volga courses through the Caspian steppes to form a huge delta as it empties into the Caspian Sea beyond Astrakhan.

Near the mouth of this river are some of the world's finest fishing grounds; farther upstream are productive lands and rich mining regions. Although there is a long frost in the winter, and summer droughts cause shallowness, the stream bears constant traffic. With lofty hills lining its right bank and with level plains on its left, much of its southern course is interesting scenically.

Cities of first importance historically and commercially have sprung up along the Volga: Nizhni-Novgorod, venerable Kazan, Saratov, Samara, Perm, Ulyanovsk and the ancient town of Astrakhan.

VOLK, DOUGLAS (1856-), American painter, was born at Pittsfield, Mass., Feb. 23, 1856. He accompanied his parents to Rome in 1870, became interested in painting and studied in the St. Luke Academy. He continued his studies in Paris, 1873, under Gérôme, and exhibited *In Brittany* in the Paris Salon, 1875. On his return to America, he was instructor at Cooper Institute, New York, 1879-84, and director of the Minneapolis School of Fine Arts, 1886-93. He became a National Academician in 1899. Among Volk's works are portraits of King Albert, Lloyd George and Gen. Pershing, in the National Gallery, Washington; mural decorations in the

Minnesota Capitol, St. Paul, and Des Moines Court House, Iowa; *Puritan Mother and Child*, Carnegie Institute, Pittsburgh; *Little Mildred*, Metropolitan Museum, New York; *Accused of Witchcraft*, Corcoran Gallery, Washington; *By the Pond*, Omaha Art Gallery.

VOLKSSCHULE, the term applied to the public elementary school in Germany. See EDUCATION, NATIONAL SYSTEMS OF.

VOLLEY BALL, a ball game which is a modification of TENNIS, the hands being substituted for a racket and a special 9-ounce ball used. It originated in the Y.M.C.A. of Holyoke, Mass., in 1895. The court is 60 feet long and 30 feet wide with the boundary lines 3 feet from any obstruction. A net 3 feet wide and 8 feet above the ground is stretched tightly across the middle, dividing the field into two equal courts, on which the players range themselves in opposing teams. In tournament games, there are 6 players on each side, though the number may be increased or decreased.

The players take positions, 3 in the front line and 3 in the back. They are called left, center and right forwards, and right, center and left backs. When the ball is served, they must be in place, though they are free to play over the range of their respective courts during the game. The captains toss for the privilege of serving and choosing courts. Service is begun by the right back, who stands behind the right-hand third of the back line and bats the ball with his hand, open or closed, over the net into the opposite court.

It is the object of each side to keep the ball in play by returning it over the net. No more than three chances to bat it are allowed each team. If the served ball fails to clear the net, side out is called, and the other team gets the service, the players rotating clockwise each time. One team, however, may continue with the same server until a point is lost by them. Side out may be called if a player catches and holds a ball, or allows it to touch any part of the body below the hip. Dribbling is forbidden. When the ball is not returned by the receiving team, one point is scored by their opponents. The winner is the first to score a 2 point lead with 15 or more points. Rules are somewhat modified for women. They are permitted a second service if the first ball does not go over the net.

VOLOGDA, administrative center of the Vologda district, in the Northern Region of the R.S.F.S.R. on the Vologda River. It was founded in 1147 as a trading point between Novgorod and the East, and lay on the Siberian trade route with Moscow; at the beginning of the 16th century it was annexed to Muscovy. Notable among the numerous churches is a five-domed cathedral. The city has repair shops for the railroads that meet here, is a center for the distribution of farm produce and is a growing industrial community. Agricultural implements, cement, leather goods, pottery and glass are made in Vologda. Pop. 1926, 57,976.

VOLOS, also Volo, the chief port of Thessaly, Greece, situated on the Gulf of Volos, at the foot of

Mt. Pelion. It is on the water route from Salonika to Piraeus and is on a spur of the Athens-Salonika railroad from Larissa. An ancient citadel rises above the city and a short distance to the south are still found the ruins of Demetrias. Pop. 1928, 41,275.

VOLSTEAD, ANDREW J. (1860-), American Congressman, was born in Goodhue Co., Minn. He was educated at St. Olaf's College and Decorah Institute, and admitted to the bar in 1884. In that year he established practice at Granite Falls, Minn., of which he was successively president of the board of education, city attorney and mayor. A Republican, he was elected to the post of county (Yellow Medicine) attorney, which he held for 14 years. In 1903 he entered the lower house of Congress, from the seventh Minnesota district, becoming a leader in farm legislation and a member of the group seeking the prohibition of liquor traffic by Federal act. He was the author of the Farmers Co-operative Marketing Act, and in 1919 framed the bill for the enforcement of the Eighteenth Amendment, commonly referred to as the Volstead Act. The bill was passed over the President's veto on Oct. 18, 1919. Volstead served in the 58th to 67th Congresses, and after 1921 devoted himself to lectures on prohibition. Since Oct., 1925, he has advised the chief of the northwestern Prohibition enforcement district.

VOLT. See ELECTRICAL UNITS.

VOLTA, ALESSANDRO (1745-1827) Italian physicist, was born at Como, Feb. 18, 1745. He became professor of physics at Pavia in 1779 and in 1815 was appointed director of the philosophical school at Padua. He discovered the electric decomposition of water, made experiments in contact electricity, constructed the famous Voltaic pile, and invented the electroscope and electrical condenser. The unit of potential electrical difference, the volt, is named after him. He traveled extensively in western Europe, and at the request of Napoleon went to Paris in 1801 to demonstrate his electrical experiments. He died at Como, Mar. 5, 1827.

VOLTA, UPPER. See UPPER VOLTA.

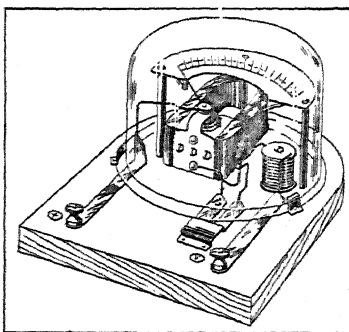
VOLTAIRE, FRANÇOIS MARIE AROUET DE (1694-1778), French philosopher, dramatist, satirist, historian and publicist, was born at Paris, Nov. 21, 1694, of middle-class parents. After an excellent education at a Jesuit school, a political scandal in 1717 resulted in his imprisonment for 11 months in the Bastille, from which Voltaire emerged to enter upon a career of extraordinary literary production, his works at death totaling 99 volumes filled with a wealth of brilliant wit, satire and invective. The tragedy *Oedipe*, 1718, and the epic *Henriade*, 1724, were the earliest works to take Paris by storm. After eight years of immense popularity in the salons of Paris his proud and irascible nature evoked political displeasure; he was exiled and fled to England. There he learned the English language and embraced advanced political and scientific views with remarkable rapidity; the famous *Letters on the English* appeared in 1729. *Zaïre*, 1732, his most distinguished dramatic

masterpiece, appeared before he had settled, for the period 1734-49, at Cirey in the château of the Marquise du Châtelet. It was during these years that he produced his other dramatic classics, *Mahomet* in 1742 and *Méropé* in 1743. In 1750 he accepted the invitation of Frederick of Prussia, with whom he had been corresponding for many years, to settle in Berlin and continued to work on that series of historical writings of which he had already produced some important volumes, notably the *History of Russia*, *History of Charles XII* and *Age of Louis XIV*. To cap this series he wrote *Essai sur les mœurs*, published in 1754, an historical masterpiece to which such authorities as Gibbon, Niebuhr, Grote and Buckle have acknowledged their indebtedness.

In 1758 Voltaire settled at Ferney, near Geneva, which became the intellectual capital of Europe. There in 1759 he wrote the satire, *Candide*; meanwhile he was participating in the production of the great *Encyclopédie*, 1752-72, and was working with great zest on his own *Dictionnaire philosophique*. In 1762 he began his struggle against official intolerance and ecclesiasticism embodied in the battle-cry, *écrasez l'infame!* The *Treatise on Toleration* was followed by an avalanche of stinging pamphlets, letters and broadsides eagerly devoured by thousands of French readers. In 1778, although then 83 years old, Voltaire paid a farewell visit to Paris, and received an extraordinary ovation. He died in Paris, May 30, 1778.

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VOLTMETER, an instrument which, when connected between points in an electric circuit, indicates the magnitude of the potential difference between the points. The moving parts are similar to those of the **AMMETER**. The principal difference in the construction of the two instruments is that the ammeter shunt



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DEMONSTRATION MODEL VOLTMETER

is removed and a large **RESISTANCE** element is connected in series with the coils of the instrument. This element is known as the *multiplier*.

With the multiplier in series with the voltmeter coils, the current through the series circuit is proportional to the voltage across its terminals. The force acting to deflect the coil is proportional to current in it, and, since the current varies directly with the applied voltage, the deflection can likewise be used to

indicate voltage. On moving coil instruments, uniform scale divisions will be obtained, while the scale of the iron-vane type will be graduated with deflections proportional to the square of the voltage.

The range of a voltmeter is readily altered by adding series resistance outside the instrument; such a resistance is frequently used on high-range voltmeters. By adding external resistance equal to that of the instrument itself, the current through it is halved for a given value of voltage. Hence, the voltage corresponding to full scale deflection becomes double the value it had without the external resistance.

Large alternating-current voltages are commonly measured with a voltmeter and a potential **TRANSFORMER**. The transformer reduces the voltage by a known ratio and brings it within the range of the instrument.

High-voltage, direct-current measurements are made either with a large external resistor or by means of an electrostatic voltmeter. The latter device makes use of the attraction between oppositely charged bodies to obtain an indication of the potential difference. In one form of this instrument the plates are allowed to move and the motion is measured. In another form, the electrostatic attraction is balanced by the electromagnetic attraction of coils carrying current. Since the two forces vary as the square of the voltage and current, respectively, the voltage to be measured is directly proportional to the balancing current.

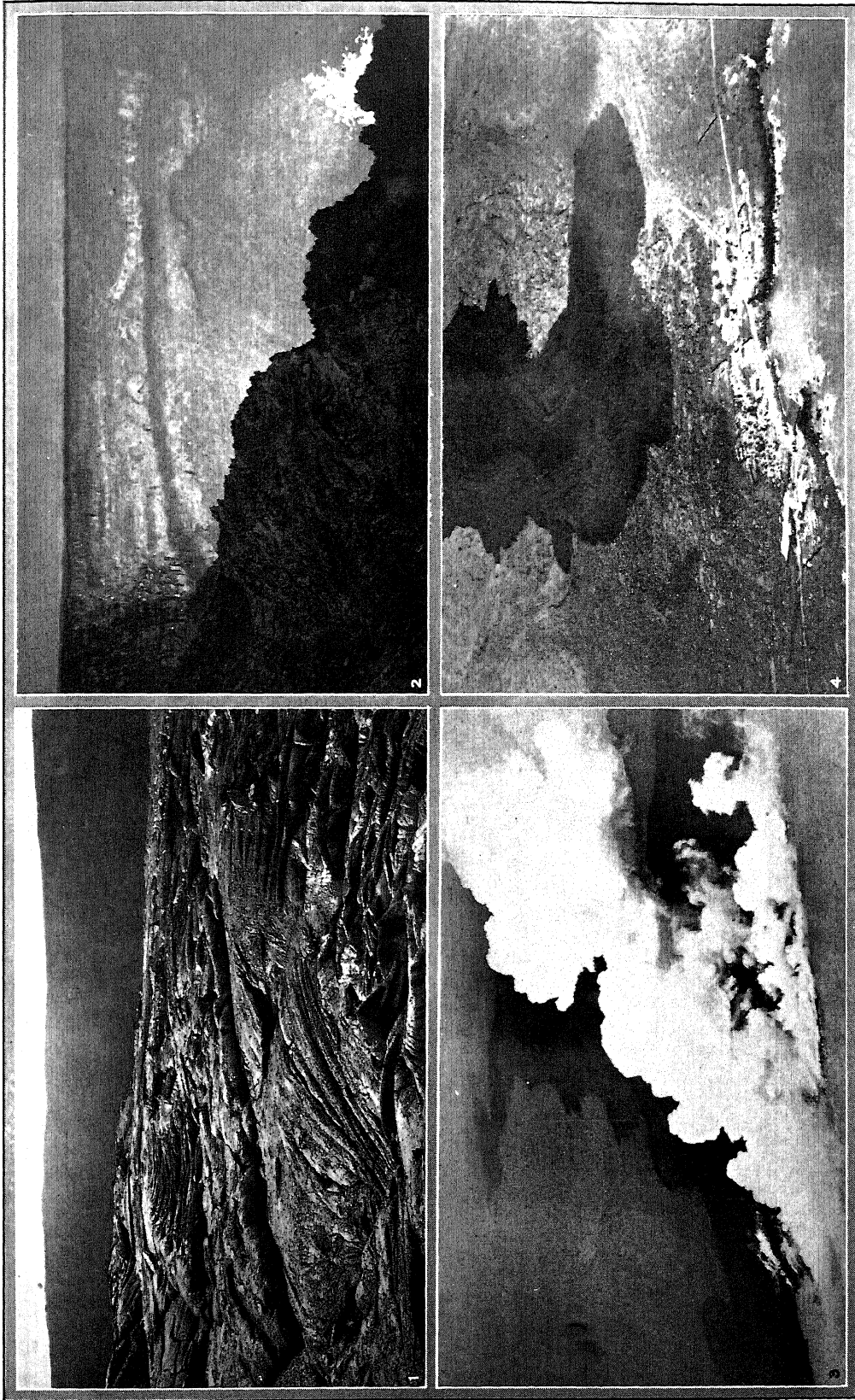
W. H. T.

VOLUME CONTROL, any device in a **RADIO RECEIVER** by which the intensity of a reproduced signal may be controlled. The most commonly used arrangement is one whereby the operating potential of the signal **GRID** with respect to the **CATHODE** may be changed. In some receivers, this potential is controlled automatically, so that a strong radio signal causes a decrease in sensitivity of the receiver, and vice versa. An additional hand-operated control is ordinarily installed, so that the operator can set the receiver for the desired volume level.

VOLUNTEER, in military or naval usage, one who joins the service of his country of his own accord and not because of a draft. In the case of a national emergency the army and navy generally issue a call for volunteers, and, failing to get the required personnel, levy a draft for the remainder of the quota.

VOLUNTEERS OF AMERICA, a quasi-military religious body which was organized in 1896, by BALLINGTON BOOTH and his wife, after they severed their relations with the Salvation Army in the United States. The organization was incorporated in the State of New York for the "uplift of the unchurched and needy." From the beginning it has served as an auxiliary to the churches, and its converts are advised to unite with churches of their own preference. It endeavors not to conflict with "any other religious military society." The term military applies only to the bestowing of titles, the wearing of uniforms and the nomenclature of its activities. Thus the society is ruled by a Grand Field Council, and

VOLCANO



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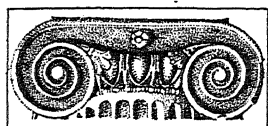
EXHIBITIONS OF VOLCANIC ACTIVITY IN HAWAII

1. Peculiar lava formations of the large Kilauea Crater bed. This mass is entirely honeycombed, galleries extending for miles outside the crater. Crater photographed at 3 a.m. by the glow of its fiery contents. The entire crater contains about 20 acres of molten lava, numerous fountains of which are continually being shot into the air to heights of 10 to 80 feet, accompanied by tremendous roarings and volumes of sulphur fumes.
2. Section of the Halemaumau crater, showing the town of Hoopuloa, Hawaii, destroyed by a lava flow. White clouds of steam arise where the hot lava comes in contact with ocean water.
3. The town of Hoopuloa, Hawaii, destroyed by a lava flow. White clouds of steam arise where the hot lava comes in contact with ocean water.
4. Hoopuloa, in the path of the slowly advancing lava stream, a photograph taken prior to picture 3. The lava stream is the dark tongue stretching down the hillside, about to engulf the town.

its branches are called posts. Its government is democratic, and all its officers are elected.

The doctrines of the Volunteers of America are in general the same as held by the Protestant evangelical churches. In addition to evangelistic work, the Volunteers maintain an extensive social service. They provide homes for ex-prisoners, unemployed, orphans, and for women and girls in misfortune. Much of this work is maintained by the gifts of those who have in the past benefited by the service. The organization is active in practically all the states of the Union, but chiefly in New York, Illinois, Pennsylvania, California, New Jersey and Ohio.

VOLUTE, a decorative spiral scroll, especially one of comparatively large size and thickness. Thus the



IONIC CAPITAL SHOWING
VOLUTES

From Greek temple of Artemis
at Sardis, 4th century B.C.

spirally curved forms of the Ionic capital are known as volutes. Many consoles, or brackets, also have the volute as an essential part of their design.

VOMITING, the act of ejecting material from the stomach through the esophagus and mouth. It is

evident that vomiting is a reflex act. It is claimed that there is a vomiting center in the medulla oblongata of the brain.

Vomiting is often preceded by a cold sweat, profuse salivation and nausea. Then the breath is drawn in deeply once or twice, followed by the closure of the glottis, at the top of the windpipe. The diaphragm and the muscles of the abdomen contract, producing pressure upon the walls of the stomach. While the cardiac valve at the top of the stomach is closed, retching occurs. Then the cardia opens and the vomitus is ejected.

The stimulus to the vomiting center may be carried from mouth or stomach. Certain drugs, such as antimony and apomorphine seem to act directly on the vomiting center.

Among the common causes for vomiting are certain alimentary conditions such as **DYSPEPSIA**, inflammation of the stomach, acute peritonitis, and intestinal obstruction. Appendicitis is often accompanied by vomiting.

In kidney inflammation, uremia, and during the first months of pregnancy vomiting often occurs. Early tuberculosis and the beginning of specific fevers are accompanied by this symptom.

In disorders affecting the brain (such as meningitis, tumors and abscesses), in hysteria, sea-sickness and diabetes, vomiting may be frequent and severe.

Among other causes for vomiting are such drugs as zinc sulphate, ipecac, apomorphine and antimony. Severe pain from gall-stones or kidney stones and injury to the testes cause vomiting reflexly.

There are also psychical causes, such as obnoxious tastes and smells or repellent sights. Severe coughing, as occurs in whooping cough, may produce vomiting through mechanical pressure on the stomach.

In children there is a disorder known as *cyclic vomiting*, in which attacks occur at fairly regular intervals, accompanied by a reduction of the alkalinity of the body tissues.

Vomiting, starting suddenly, indicates abdominal disease such as appendicitis, the beginning of acute specific fevers, or toxic poisoning.

Vomiting not accompanied by nausea appears in brain disorders and mental disturbances known as neuroses. The vomiting of bloody material often indicates ulcer or cancer of the stomach. When fecal material is vomited, the cause is usually intestinal blocking.

W. I. F.

VONDEL, JOOST VAN DEN (1587-1679), Dutch poet and dramatist, was born at Cologne, Germany, Nov. 17, 1587, the son of a humble Dutch tradesman. He became one of the greatest names in Dutch literature and has often been called the Dutch Shakespeare. His first drama, *Het Pascha*, 1612, started him on the brilliant dramatic career that led to his masterpiece, *Lucifer*, a poetic drama thought to be an allegorical account of the revolt of the Netherlands against Philip of Spain. Milton is supposed to have been indebted to this play. Vondel died at Amsterdam, Feb. 5, 1679. See also **DUTCH LITERATURE**.

VON PAPEN, FRANZ (1879-), German Chancellor, was born on Oct. 29, 1879. As German military attaché he was expelled from the United States in 1915, together with Capt. Karl Boy-Ed, naval attaché. Von Papen served on the western front in 1916, later becoming chief of staff of the Fourth Turkish Army. In 1921 he was elected to the Prussian Diet as a Centrist Party candidate, and exercised considerable influence without coming into prominence himself. On May 31, 1932 he was commissioned by President Von Hindenburg to form a cabinet, and succeeded Dr. Brüning as Chancellor. On July 20, 1932 the new Chancellor was appointed Federal Commissioner for Prussia, with practically dictatorial powers.

VORONEZH, administrative center of the Central Black Soil Region of the R.S.F.S.R. It is built on the Voronezh River near the point where it joins the Don. It is a busy railway and export center, and its grain elevators, machine works, flour mills, and numerous small factories testify to its growing industrial prominence. Voronezh was founded in 1586. Its situation along the route to the Black Sea led to the establishment of wharves for sea-going vessels by Peter the Great, and early in the 18th century industrial enterprises developed along with exports of grain, wool and fat. There are splendid educational institutions and a fine Provincial Museum. Pop. 1930, 144,050.

VÖRÖSMARTY, MIHÁLY (1800-55), Hungarian poet, was born at Nyék, or Puszta-Nyék, Hungary, Dec. 1, 1800. He studied law in Pest, graduating in 1824, and then devoted himself to literature. He had already published one drama in 1821, followed by another entitled *King Sigismund*, 1824. Vörösmarty soon became celebrated as an epic poet and

produced some of the best narrative poems in Hungarian literature, including *Cserhalom*, 1825, and *Két szomséd vár*, 1831. In 1840 he composed *Szózat*, the Hungarian national anthem. His political exile after the Revolution of 1848 saddened his later years. A translation of Shakespeare, begun in 1854, was interrupted by the poet's death at Pest, Nov. 20, 1855. See also HUNGARIAN LITERATURE.

VORTICELLA, the name of a large genus of one-celled animals belonging to the Infusoria. Members of this genus are called bell animalcules, because their bodies are bell-shaped. They are widely distributed in both salt and fresh water. Generally they are attached to some object, such as a water plant, by a long slender stalk, which is provided with thread-like muscle bands (*myonemes*). When these are contracted the stalk coils up like a watch spring. At the large end of the bell are the cilia, which fan food into the mouth.

Vorticella multiplies by division; one individual remains attached to the stalk, while the other, developing new cilia, swims away and later grows a stalk of its own. Conjugation takes place between a free and an attached individual, the former being wholly amalgamated with the latter. See also INFUSORIA; PROTOZOA.

VORTIGERN, King of the Britons at the time of the landing of the Saxons under HENGIST AND Horsa. He is said to have married the daughter of Hengist. The dates are uncertain, and the names of the principals may be only legendary.

VOSGES MOUNTAINS, a range of mountains in eastern France, extending almost parallel to the Rhine River and separated from the Jura Mountains by the Doubs valley. The Vosges are rich in pastures and forests, and in the lower slopes are vine-clad. The Ballon de Guebwiller, reaching a height of about 4,600 ft., is the highest point. Minerals such as rock salt, silver, copper and coal are found in the mountains.

VOSS, JOHANN HEINRICH (1751-1826), German poet and translator, was born at Sommersdorf, Feb. 20, 1751. Invited by Boie to Göttingen in 1772, he became a member of the renowned *Dichterbund*, and in 1775 succeeded Boie as editor of the *Musen-almanach*. Voss's poems, published from 1785-95 and including the famous *Luise*, were eclipsed by his masterly translations of Homer, Hesiod, Horace, Vergil and other classical poets. From 1818-29 he translated Shakespeare's plays. Voss died at Heidelberg, where he had been a professor, Mar. 29, 1826.

VOTING, COMPULSORY. The indifference of the electorate to their civic duties in certain democratic states has led to the enactment of compulsory voting laws. Among the states which have enacted such laws are Belgium, Spain, Czechoslovakia, Denmark, Holland, Hungary, Argentine, Honduras, Mexico, Salvador, New Zealand and Australia. In Australia a fine of \$10 is imposed for failure to register or vote.

See E. M. Sait, *American Parties and Elections*.

VOTING RIGHTS, the rights of a stockholder, as owner of shares usually of common stock, to participate in the control of the corporation by means of a vote. Usually, stockholders of record are entitled to one vote for each share of stock owned. PREFERRED STOCK rarely carries voting rights although such participation in control is sometimes specified when such stock is issued. See also STOCKS.

VOWEL-HARMONY, a linguistic phenomenon in which the vowels of formative suffixes are assimilated in coloring to the final vowel of the radical element of a word. While it occurs sporadically in many languages, it is especially characteristic of TURCO-MONGOL-TUNGUS and FINNO-UGRIC, as in the TURKISH locative plural *tash-lar-da*, "in the stones," but *el-ler-de*, "in the hands," or the first person singular present *gel-ir-im*, "I come," but *gül-ür-üm*, "I laugh."

VRANYA, a town of Serbia, YUGOSLAVIA, situated on the Morava River. The town is spread over hills and hollows, and is the market for an extensive district rich in the production of flax, hemp, maize, wheat, vegetables and fruit. Ropes, ironware, glass, lamps, boots and caps are manufactured. About 5 mi. to the east is Vranyska Banya, a celebrated hot springs resort. Vranja became part of the Serbian kingdom at the conclusion of the Russo-Turkish War in 1877-78. During the World War, it was occupied by the Bulgarians but was restored to Serbia by the peace treaties of 1919. Pop. 1931, 9,817.

VRATZA, a town of Bulgaria, situated on the northern slope of the Balkan Mountains, about 40 mi. from Sofia, with which it is connected by rail. Capital of the department of Vratza, it is also the see of an archbishop of the Bulgarian Greek Orthodox Church. It is a trading center for gold and silver filigree, wine, and leather goods. Nearby is the grave of the celebrated Bulgarian poet-revolutionist Christo Boteff who was killed by the Turks in 1876. Pop. 1931, 15,800.

VRCHLICKÝ, JAROSLAV (1853-1912), pseudonym of Emil Bohush Frida, Czech poet and dramatist, who was born at Laun, Bohemia, in 1853. He was educated at Prague, and in 1893 became Professor of Literature in Czech University. In 1901 he was made a member of the Austrian House of Lords. He was long the chief personality connected with the periodical *Lumir*. Vrchlický, perhaps the greatest figure in Czech literature, wrote some 70 volumes of poetry, besides translating copiously from Victor Hugo, Camoens, Goethe, Walt Whitman, Calderon and others. He also published 15 volumes of criticism, essays and stories, and more than 30 dramas, including *Julian the Apostate* and *The Death of Ulysses*. Vrchlický greatly enlarged the field of Czech culture and emancipated the Czechs from undue reliance on German sources. When he died, in 1912, his works had reached a total of 250 volumes.

VULCAN, in Roman mythology, the god of fire. He is identified with the Greek HEPHAESTUS, although in the Roman divinity there seems to have

been more the idea of fire that consumes, as is shown by the festival Volcanalia, when Vulcan was propitiated under the title of Volcanus Quietus Augustus, against the fires that ravaged the land or city. At the Volcanalia the Romans threw small fish on the fire which was lighted to the god. Vulcan was a son of JUPITER and JUNO, and the husband of



VULCAN OR HEPHAESTUS WITH THETIS

VENUS. Cast from heaven as an infant, he spent much time with THETIS, who gave him protection. He was especially skilled in fashioning ornaments and arms for gods and heroes, and had workshops on many volcanic islands. Vulcan was later taken back into Olympus.

VULCANISM. See VOLCANISM.

VULCANIZATION, the process of converting RUBBER into a material less affected by heat, cold, and organic liquids and possessing greater hardness, toughness and elasticity. This is usually done by mixing sulphur with the rubber and heating it. In the case of ordinary soft rubber goods, from 1 to 10 parts of sulphur per 100 parts of rubber are used. If the sulphur is increased to from 20 to 50 parts, and if the rubber is heated for a long enough time, hard rubber or ebonite is formed. The temperatures ordinarily used in vulcanizing processes are from 230° to 310° F.; the time from 10 minutes to 3 hours (the higher the temperature the shorter the time). The time required to reach a given state of cure is approximately halved by every increment in temperature of 13° F. W.A.G.

Accelerators are commonly employed for the purpose of improving the quality of the cured articles or shortening the time of the vulcanization period and permitting the use of a lower vulcanization temperature. Although inorganic chemical compounds such as lime, magnesia and litharge have been used in rubber goods for many years, organic compounds have been employed as accelerators in greatly increasing quantities since approximately 1908. Relatively few classes of organic compounds are effective as accelerators, and those used in greatest volume have been amines or reaction products of amines. R.L.S.

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VULPECULA (gen. *Vulpeculae*), the fox, an inconspicuous constellation just south of Cygnus. See STAR: map.

VULTURE, the name applied to large, carrion-eating birds of prey, native to tropical and warm regions. They are closely allied to the hawks, falcons and eagles, but have weaker feet and claws and usually naked heads. The vultures are mostly birds with long strong wings and majestic flight, soaring with ease and grace to immense heights. They comprise two distinct families: the New World vultures, *Cathartidae*, and the Old World vultures, *Vulturidae*, generally of similar appearance and habits, but differing in structure.

The American vultures, which comprise some of the largest birds of prey, are sluggish, voiceless birds, with perforated nostrils and a slightly hooked bill. All feed mostly, though not entirely, upon carrion, and, when startled, immediately eject the offensive contents of their stomachs. Because of their voraciousness several are valuable as scavengers. The American species include the turkey vulture, the American black vulture or carrion crow, the brilliantly colored king vulture of tropical America, the great California condor and the true condor of the Andes.

The Old World vultures are large birds from 2 to 4 ft. long, with imperforate nostrils. Among the best known are the black vulture and the white or Egyptian vulture, called also Pharaoh's chicken. See also CARRION CROW; CONDOR; GRIFFON; LAMMERGEIER; TURKEY VULTURE.

VUNTAKUTCHIN, a North American Indian tribe, a member of the Kutchin group of the northern division of the Athapaskan linguistic stock. They occupy the district north of the Porcupine River in Alaska, making contact with the Eskimo on the Arctic coast. They trade habitually at Fort Yukon and Fort Egbert. They are nomadic hunters and fishermen, following wherever game, caribou, moose, bear and mountain-sheep, is abundant in winter and in summer, and fish for salmon. Summer transportation is by canoe; winter travel by snowshoe, toboggan and sledge, the two latter drawn by dogs which are also used as pack animals. Though now living in poorly constructed log-cabins, their original dwelling was the caribou-skin covered conical tent. Their clothing was of caribou, moose or sealskin, the last obtained from the Eskimo, highly decorated with elaborate porcupine quillwork, now replaced by white man's costume. Spruce-root baskets and utensils of wood and birchbark were commonly made; these and the ancient stone and bone implements have been replaced by metal tools and utensils. Government was by a single chief in whose absence a council of elders functioned. Various tribal feasts, as at birth, puberty and killing of the first game, play an important part in the ceremonial life. A form of POTLATCH is held on the death of a chief.

See C. Wissler, *American Indian*.

W

WABASH, a city in northeastern Indiana, the county seat of Wabash Co., situated on the Wabash River, 88 mi. northeast of Indianapolis. Served by two railroads, the city handles the agricultural crops of the region, chiefly grain and dairy products. Wabash has many manufactures, including paper, wood-working machinery and filing cabinets. As early as 1880 an electric lighting plant was established here, making Wabash the first city in the world to use electricity for street lighting. The city has a private airport. Wabash was founded in 1835; incorporated in 1872. Pop. 1920, 9,872; 1930, 8,840.

WABASH COLLEGE, at Crawfordsville, Ind., an institution for men, was founded in 1832. It is privately controlled and affiliated with the Presbyterian Church. Originally named Wabash Manual Labor College—Teacher's Seminary, it received its present title in 1851. It had productive funds in 1931 amounting to \$2,282,503. The library contained 71,420 volumes. In 1931-32 there were 379 students, and a faculty of 30, headed by Pres. Louis B. Hopkins.

WABASH RIVER, a tributary of the Ohio, rising in the Grand Reservoir in Mercer Co., Ohio. It flows generally westward across Indiana and south to Terre Haute just below which it forms the boundary line between Illinois and Indiana for some distance before discharging into the Ohio at the southwestern extremity of Indiana. The area drained, covering 33,000 sq. mi., is a level and open region which is thickly settled and highly cultivated. On its course the river passes the cities of Huntington, Wabash, Peru, Logansport, Covington and Terre Haute. It is 517 mi. long, has a fall of 700 ft. and is navigable to Terre Haute. Above this point navigation is impractical because of many bridges. The White River is the chief tributary.

WACE or **EUSTACE, ROBERT** (c. 1100-c. 1175), Anglo-Norman poet, was born on the island of Jersey, about 1100. He is the author of two notable poetical romances. The first entitled the *Geste des Bretons*, or *Roman de Brut*, is based mainly on the Latin *History of the British Kings* by GEOFFREY OF MONMOUTH; it traces the history of Britain from the time of Brut, the great-grandson of Aeneas, to Cadwalader. The second poem, the *Roman de Rou*, or *Romance of Rollo*, is a story of the Norman Conquest. Wace died about 1175. See also ENGLISH LITERATURE.

WACHUSETT MOUNTAIN PARK, situated in Princeton and Westminster counties, north central Massachusetts, established in 1899 and comprising 1,500 acres. Wachusett Mountain rises 2,000 ft. above sea level. There are numerous mountain trails and a camping house at the summit.

WACO, a North American Indian tribe, one of the sub-tribes of the TAWAKONI, belonging to the Cad-

doan linguistic stock. First encountered by this name in the 19th century, at the site of the modern city of Waco, Texas, the Waco appear to be identical with the Tawakoni peoples found on the Brazos River in Texas in the 18th century. In 1872 they were established with the Wichita in Oklahoma but have been admitted to citizenship since 1902.

WACO, a city and county seat of McLennan Co. in central Texas, is built on both sides of the Brazos River and situated 95 mi. northeast of Austin. Bus lines, airplanes and several railroads serve the city. It is a progressive trading center for live stock, farm crops and factory products. Cement, window sashes, doors, furniture, milk products, structural steel, cotton clothes and machinery are manufactured. In 1929 the value of the factory output was about \$13,000,000; the retail trade amounted to \$33,415,787. The city was laid out in 1849 by George Erath and incorporated in 1850. The city's name is from the Waco, or *Hueco*, Indians who had a large settlement here before the white man came. It is the seat of Baylor University, founded in 1845. Pop. 1920, 38,500; 1930, 52,848.

WADE, BENJAMIN FRANKLIN (1800-78), American political figure, was born near West Springfield, Mass., Oct. 27, 1800. He moved to Ohio in 1821, was admitted to the bar in 1827, and elected Prosecuting Attorney of Ashtabula Co. in 1835. In 1837 and 1841 as a Whig he was state senator. He was elected to the national Senate in 1851 but left the Whig Party and was reelected as a Republican in 1856, where he served until 1869. He was opposed to slavery and to any compromise whatever with the South. As chairman of the committee on the conduct of the war 1861-62, he advocated the policy of confiscating the property of leading secessionists, and of emancipating the slaves. He considered Lincoln's plan for reconstruction too lenient, and his name was attached to the much more severe Wade-Davis bill which Lincoln pocket-vetoed. He was elected President *pro tempore* of the Senate, Mar. 2, 1867 and served until Mar. 3, 1869. He consistently opposed President Johnson's policies, and voted for his impeachment. After his defeat for renomination in 1868 he resumed his law practice in Jefferson, O. In 1871 he was a commissioner to Santo Domingo to report in regard to its annexation. He died in Jefferson, O., Mar. 2, 1878.

WADSWORTH, a city in Medina Co., northeastern Ohio, situated 33 mi. south of Cleveland. It is served by the Erie Railroad. The city is in good farming country. The chief local manufactures are locomotive injector engines, valves, matches, shade cloth, flour and lumber. Pop. 1920, 4,742; 1930, 5,930.

WAFER ASH, a name sometimes applied to the HOP TREE on account of its dry, flat, wafer-like

fruits. The tree is a native of North America often planted as an ornamental.

WAGE FUND THEORY, the doctrine, unassailed between 1820 and 1866, that average wages depend upon the relation between "that part of CAPITAL . . . which is destined for the direct purchase of labor" and the number of workers. It was rendered plausible in England, where it had its birth and development, by the abundance of capital and neediness of labor after the Napoleonic wars. The theory was matured through the writings of T. R. MALTHUS, James Mill, J. S. MILL, and H. FAWCETT. It was successfully assailed by Longe (1866), Thornton (1869, 1870), and by F. A. Walker (1876). Cairnes made a modified argument for the wage fund in 1874 even after J. S. Mill recanted in 1869. Walker showed that the wage fund, did it exist, need not all be distributed, and that wages are paid out of current production, which may increase with an increased number of workers. This last view was further illustrated by HENRY GEORGE (1879). B.M.

WAGER OF BATTLE. Combat as a means of settling disputes by an appeal to the judgment of God was introduced into West European jurisprudence by the Germans. It could be utilized not only against a principal, but also against a witness to prove the falsity of his testimony, or even, on occasion, against the judge to challenge his judgment. The Lateran Council of 1215 condemned the practice, and Louis IX of France forbade its use in his domain. Its last use in France was in 1549. In England it was formally abolished in 1819, having long been unused.

WAGES. Speculation about wages has been fundamentally influenced by the progress of workers from status to contract—that is, from a position in which laborers enjoyed only those rights which employers and society wished to accord them, to a condition in which they make demands on their own account. Economic thinking has given tardy admission to this ascent from slavery to freedom, and there is still sufficient progress to be made in theorizing as in fact, for the independence of the workers is qualified by poverty, immobility, unemployment and industrial hazards outside of their control.

Seven successive and fairly distinct doctrines of wages may be mentioned as having been entertained in the last three centuries in the western world.

1. The Oppression Theory. In the 17th and early 18th century, when serfdom was more than a recent memory, the majority view was that the worker was a low order of being who must be kept virtuous and industrious by economic necessity. If he received enough in three days of work to last out the week, he would labor no more until his resources were exhausted. Consequently he should be paid the lowest wages consistent with maintenance of life. 2. The Subsistence Theory was closely linked with the oppression theory, but it was conceived of as more in the order of nature, and less a matter of design on the part of masters. Two influences particularly op-

erated to form it. The Poor Law made allowances to laborers in supplement of wages, and yet it was observed that the condition of the workers was not bettered. In the second place, T. R. MALTHUS' principle of population asserted that population constantly tended to outrun the food supply. D. RICARDO enunciated what others called the iron law of wages, namely, that workers would receive, in the long run, just enough to maintain their numbers without increase or diminution; if they received more than enough for subsistence, their numbers would increase, there would be less food to go around, the DEATH RATE would outrun the BIRTH RATE, readjustment would occur and the process be repeated.

3. The WAGE FUND THEORY was, in turn, closely connected with the Subsistence Theory, but the criterion of wages, besides the numbers of the working population, was made the funds set aside by employers and destined for the payment of wages. Average wages could not rise except by an increase in the wage fund or a decrease in the number of workers, or fall except by a shrinkage of the fund or an increase in the applicants for shares in it. This theory was used as an argument against the ability of trade unions to improve wages for the body of workers. 4. The Exploitation Theory. Before the wage fund doctrine was disproven by events and by analysis, K. Marx, returning for his authority to A. Smith and D. Ricardo, formulated the socialist contention that all value proceeded from labor, and that hence interest, rent and profits were filched by owners of land and capital from the reward of workers. 5. The Residual Claimant Theory. This doctrine, if it did not accord self-determination to workers, at least allowed less volition to other classes in the productive process; it was to the effect that rent, interest and profits were settled by definite laws, and that the remainder went to the remuneration of labor. 6. The Productivity Theory asserts that wages accord with the marginal productivity of labor, that all workers within an identical group tend to receive what the last worker employed adds to the total product. 7. The Bargain Theory is a combination of the subsistence, productivity, and wage fund theories. It holds that wages, within limits, are settled by the higgling of the market, the upper limit being what the employer thinks he may realize from the production of the worker, and the lower limit being the subsistence level or standard of living of the worker. See also REAL WAGES. B.M.

WAGES, STATISTICS OF. There are no figures, except as comprised in estimates, for total wages paid in the United States. The chief agencies collecting wage data are the United States Bureau of Labor Statistics, both material from pay rolls of manufacturers and union scales, the National Industrial Conference Board, the most complete series of hourly earnings in manufacturing industries and various state departments of labor. Hourly earnings, in the present state of wage information, form the best criterion of changes in wages; hourly earnings, of course,

are not comparable with full-time weekly earnings, because of changes in the length of the nominal full-time week. Wages in the United States advanced sharply from the pre-war level to 1920, the high point of business activity; during the depression of 1921-22 wages were reduced, but not to the pre-war level; with business recovery, wages rose until 1930, the ascent being steeper at first than afterwards; the depression which followed the collapse of the stock market in the autumn of 1929 brought a lowering of wages, at first scattered, but then more widespread. In 25 manufacturing industries, according to figures of the National Industrial Conference Board, average hourly earnings were 61 cents in the second half of 1920 as compared with 25 cents in July 1914, an increase of 150%; from 1920 until the last quarter of 1922, there was a decrease to 49 cents, when wages were 100% above July of 1914; wages then rose to 56 cents in the fourth quarter of 1923, being 129% above 1914; from the beginning of 1924 there was a gradual rise to 58 cents at the end of 1929, or 138% over 1914; in the first five months of 1930 there was very slight departure from this figure. In changes in hourly earnings, the skilled and semi-skilled male workers in general paralleled the experience of all wage earners in the rise of wages above respective 1914 levels, in a more particular view; margins between wages of skilled and unskilled narrowed between 1914 and 1920, widened in the period of depression, and toward the end of the decade narrowed again. Comparing wages for different groups of workers in 1914 and 1929, hourly earnings in manufacturing increased 137%; in railroading, 152%; in electric plants, 127%; in gas works, 113%. Wage rates per hour in the building trades rose 136%, and wage rates per day in agriculture 66%. Weekly earnings in manufacturing increased 125% in this period. In 1929 average hourly earnings differed greatly in different manufacturing industries, going all the way from 32 cents in southern cotton mills to 88 cents in news and magazine printing; lowest and highest average weekly earnings were also in these two industries. No account is here taken of perquisites of southern cotton mill operatives; excluding these workers, the lowest hourly and weekly earnings were in the northern cotton mills. The average weekly earnings of women in 1929 were, for all industries, \$17.67, comprehending a range from \$13.02 to \$21.36. The largest increase in hourly earnings in manufacturing from 1914 to 1929 was in the case of women workers, 160%; for unskilled male workers the increase was 148%. The average number of hours actually worked per wage earner per week in 1929 in manufacturing industries was 48.6; in 1914 it was 51.5. On the railroads the change in this respect was from 59.7 in 1914-15 to 49.8 in 1929. The nominal week in manufacturing was reduced from 55 hours in 1914 to 49.6 in 1929, almost five and a half hours. Throughout post-war years the volume of unemployment was large and persistent, rising sharply to unprecedented heights in 1930-

31. The largest volume of employment after the 1920-21 depression was in 1923 and 1929, when it averaged about 10% below the peak of June 1920. As to union wages, the average rate per hour on May 15, 1929 was \$1.20; taking the hourly rate in 1913 as equal to 100, the rate in 1907 stood at 89, and in 1929 at 262; in 1929 the rate was two and five-eighths times as much as in 1913. Between 1900 and 1929 the output per worker engaged directly in production increased some 80%. Wages of agricultural workers, which in their relative increase had paralleled those of industrial workers, suffered more in the depression of 1920-21; in 1929 the wages of the former were 67% above 1914, those of the latter 125%.

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WAGE SYSTEMS IN INDUSTRY. Fundamentally, there are two bases of wage payment—by time worked and by output. Though each of these has a relation to the other—an inefficient time worker is liable to dismissal, and **PIECEWORK** rates cannot neglect the standard of living—they are for practical purposes distinct. While there are variants of time work, as where accomplishment of a given task or stint is made a condition of receiving the time wage, the piecework system is far the more complicated of the two, and appears in more forms. The timework basis is apt to be standard for all workers of the same grade; piecework plans involve difference in wage to individual workers. Under simple piecework, the worker receives a flat amount for each operation, but employers, in the attempt to induce additional effort on the part of the worker, have devised special forms of piecepayment, and have introduced schemes which involve time-payment, piecepayment, and bonus or other reward features. Piecework is best adapted to repetitive operations, but has been applied, usually with considerable additional cost for installation and administration, to cases of unstandardized processes. **COLLECTIVE BARGAINING** by the workers in setting the piece rates is more apt to be effective under the first condition than under the second. In a few instances, piecework systems involve a diminution in the rate after a certain point in the worker's production has been reached, while in other cases the rate increases with increased output. However, rather than a progressive piece rate, the employer more often seeks to provide incentive by offering a bonus for high production—the bonus being added either to a time wage or to a piecewage. In various efficiency systems the basis is neither time-work nor piecework, but a combination of the two in the form of a time allowance in which the employee is supposed to get through a certain amount of production. In the simplest case of the Halsey system the worker receives 30 to 50% of his time rate for time saved above the time limit or allowance which has been set. The regular time rate is guaranteed

to every worker who is employed at all. From the standpoint of the worker, everything hinges upon the liberality or strictness with which the time allowance is fixed. There are many variations of this plan; the Rowan system reduces the reward after 50% increased output has been achieved, the Taylor differential piece rate sets a standard above which higher and below which lower rates prevail. In connection with this system Taylor introduced meticulous time and motion studies. PROFIT SHARING is a special form of payment by results. Piecework and the special incentive systems generally have the effect of increasing wages and output, and decreasing unit cost. On the other hand, they are sometimes met by one or another sort of restriction of output on the part of workers, either to forestall reduction of piece rates or to prevent over-driving. Special incentive systems are notably weakening to collective bargaining. B. M.

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WAGNER, HONUS P. (Hans) (1874-), baseball player, was born at Carnegie, Pa., Feb. 24, 1874. He followed his older brother Albert into professional baseball, joining the Pittsburgh National League team. (The Pirates.) He was champion batter of the National League in 1900, 1903, 1904, 1906, 1907, 1908, 1909, and 1911. His highest batting record, .384, was made in 1900. At the close of the 1917 Major League season, he retired from professional baseball and opened a sporting goods store in Pittsburgh. In 1929 he was appointed Assistant Sergeant-at-arms for the Pennsylvania State Legislature. Wagner, known familiarly as the Flying Dutchman, has been considered the greatest shortstop of all time and by many the greatest player baseball has produced.

WAGNER, OTTO (1841-1918), Austrian architect, was born at Penzing, July 13, 1841. He designed a number of industrial works and buildings, including the Berlin union station and the Vienna land bank, and superintended large sections of the flood control works along the Danube. He was also the designer of many churches and private houses, and his work, in breaking away from the prevailing eclecticism, was of great influence in founding the modern functional architecture of central Europe. In 1894 he became professor of architecture at the Vienna Academy of Arts. He died at Vienna Apr. 12, 1918.

WAGNER, WILHELM RICHARD (1813-83), German music and dramatic composer, was born at Leipzig, May 22, 1813. His father, chief of police at Leipzig, died during his infancy, and his mother remarried. To his stepfather, Ludwig Geyer, who was an actor and playwright, Wagner's early interest in the theater may be attributed. As a child he wrote a tragedy in free verse. Upon hearing BEETHOVEN's *Egmont* overture at the age of 15, however, he determined to become a composer, studying theory by himself and with Gottlieb Müller; soon afterward, while a student at the University of Leipzig, he continued his musical studies with Theodor Weinlig.

At the age of 20 he became chorus-master at the Würzburg Theater, and three years later, in 1836, he was appointed conductor of the Königsberg Theater. Meanwhile he had composed *Rienzi*, his first opera save for two youthful endeavors, *Die Feen* and *Das Liebesverbot*. Journeying to Paris, he was unable to secure production of *Rienzi*. His stormy voyage thither nevertheless furnished him with the inspiration for *Der fliegende Holländer* (The Flying Dutchman) which was produced in Dresden in 1843 a few months after the production there of *Rienzi*, and at the same time he was appointed conductor of the Dresden Opera, where he remained for six years. The revolution of 1849 forced him to flee the city and he escaped to Zurich. Befriended by FRANZ LISZT, he remained in seclusion for six years, composing little, but writing furiously on reform in operatic music. Toward the end of his period of isolation he began work on THE RING OF THE NIBELUNGEN, completing the score of *Das Rheingold* (part I) in 1854. In 1855 he appeared as a conductor of the London Philharmonic Orchestra, and in 1856 he returned to the Ring, completing *Die Walküre* (part II). *Tannhauser* and *Lohengrin* had been produced a few years earlier, but a general want of response made him fear that his projected tetralogy would find little favor; consequently he temporarily abandoned it, composing *Tristan und Isolde*. Unfortunately, after 57 rehearsals the opera was abandoned as too difficult. Still undaunted he began work on *Die Meistersinger*. His financial position was exceedingly precarious, and only the timely aid given him by King Ludwig II of Bavaria permitted him to finish his comic masterpiece as well as to bring the Ring to completion. Thereafter he continued to expound his views on dramatic music, and composed his last opera, *Parsifal*. At the age of 23 he had married an actress, Wilhelmine Planer, from whom he separated in 1861. Soon afterward he formed a liaison with Cosima, daughter of FRANZ LISZT and the Countess d'Agoult, who had become the wife of HANS VON BÜLOW, the pianist; in 1870 he married her. Of this union there was one son, Siegfried Wagner (1869-1930).

In the realm of operatic music Wagner stands very nearly supreme. His use of the leit-motif, or recurrent theme associated with some particular situation or character, was not his invention, but no other composer before his time had drawn from it such endless riches. His own librettist, he conceived the opera as a unified creation of tone and drama, the indissoluble marriage of two forms of expression. He died at Venice, Feb. 13, 1883. For further details consult his operas described under their various titles; see also MUSIC: GERMAN.

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WAGRAM, BATTLE OF, one of the major Napoleonic engagements, fought July 5-6, 1809, on the north side of the Danube near Vienna. The battle

derives its name from the village of Wagram, on the east bank of the Russback river, 11 miles northeast of the Austrian capital. Removing his forces of 181,700 troops from the island of Loban, in the Danube, NAPOLEON advanced over the plain, making contact at Wagram with the Austrian forces, numbering 128,600, led by the Archduke Charles. In the ensuing conflict the French losses were estimated at 23,000 killed and wounded, with 7,000 missing, and the Austrian casualties at 19,110, with 6,740 missing. Wagram was one of Napoleon's important victories for it was followed by the peace of Vienna, Oct. 14, which brought Austria into the Alliance with the French Empire and the continental system and paved the way for the marriage of Napoleon with Marie Louise, the daughter of the Austrian ruler.

WAGTAIL, one of a family (*Motacillidae*) of largely Old World birds, so-called from their habit of constantly jerking their tails. They have trim, slender bodies, rather long, pointed wings, long tails and usually variegated black, white and gray plumage. Terrestrial in habit, they frequent the borders of streams or open places, where, walking or running about in a graceful manner, they seek their insect food. The pied wagtail (*Motacilla lugubris*), of Great Britain and western Europe, is about $7\frac{1}{2}$ in. long with black and white plumage. It has a loud hurried warble and nests usually in a hole in a bank or rock laying 4 or 5 spotted, bluish eggs. Other well known European species are the white wagtail (*M. alba*) and the yellow wagtail (*M. rayii*), also occurring occasionally in western Alaska. See also PIPIT.

WAHHABIS, a sect of Moslems founded by Mohammed, son of Abdu'l-Wahhab, an extreme conservative in religion. Mohammed was born in the Najd, Arabia, in 1691. He visited Mecca, Basra, Baghdad and elsewhere, bent upon the study of Canon Law. His conservative training moved him to react against current liberal interpretations of Islam, and ultimately he swung to the extreme of opposition to costly clothing, ornamented tombs, etc. as well as to drugs, drink and other departures from the Prophet's teachings. It is enough to say that the Wahhabi reformer was a literalist and a Puritan, questioning khalifs, most festivals, rosaries, etc. Under their present leader, Ibn Saud, they are now in control of the Moslem Holy Land. Elsewhere, as in India, they are a minor element in Islam.

WAHOO (*Euonymus atropurpureus*), a small tree of the staff-tree family closely allied to the SPINDLE TREE, called also burning bush. It grows in rich woodlands from New York to South Dakota and southward to Alabama and Texas. The slender trunk bears spreading branches, oblong, minutely toothed leaves, small deep purple flowers in loose clusters and a smooth, light purple, deeply lobed fruiting capsule which splits open at maturity disclosing large seeds encased in a showy, red aril.

WAHPEKUTE, one of the four subdivisions of the Santee, an eastern sub-group of the North American Indian DAKOTA of the Siouan linguistic stock.

They are closely affiliated with the Mdewakanton with whom they lived at Mille Lac, Minn., when first discovered by the French in 1678-80. Later they were encountered successively along the Minnesota River and roaming between it and the Missouri River, and hunting along the Des Moines River. After 1834 they were established in villages along the Cannon River and later were at war with the Sauk and Fox. In 1857 they took part in the massacre at Spirit Lake and Springfield, Minn., and also participated in the massacre of 1862. Eventually they were segregated with the Wahpeton on the Santee Reservation in Nebraska, where they now live.

WAHPETON, one of the seven primary divisions of the DAKOTA, belonging to the Siouan linguistic stock. According to Lewis and Clark they lived just above the mouth of the Minnesota River. By 1849 they had moved so far upstream that their villages extended to the river's source. They practised agriculture to a limited extent, devoting much of the year to hunting buffalo.

WAILATPUAN, a North American Indian linguistic stock comprising two dialectically distinct groups, the CAYUSE and the MOLALA. The latter occupied the district between Mounts Hood and Scott as well as Molala Creek in western Oregon; the former occupied the lands from the Des Chutes River in the Blue Mountains, including the headwaters of the Wallawalla, Grande Ronde and Umatilla rivers in Oregon and Washington. Never numerous or well-known culturally, the Wailatpuan are now extinct.

WAILAKI, a North American Indian tribe belonging to the coast division of the Athapaskan linguistic stock. Their villages were formerly on the Eel River and its north fork from Kekawaka Creek to the vicinity of Round Valley, Calif. As with other California tribes, the immigration of whites was the cause of fighting which ended in the segregation of the Wailaki on the Round Valley Reservation where the survivors of the tribe now live, raising cattle and poultry and making a little basketry and beadwork. In aboriginal days they subsisted in the main by fishing with nets and spears. This fish diet was supplemented by roots, seeds and nuts gathered by the women in summer and fall, and by deer hunted by the men. They had a unique custom of taking the heads of their enemies as trophies, and using them in their dance. Other important ceremonial occasions were the girl's adolescent dance, the dances of the boys under training by the shaman and the building of large conical dance-houses.

WAINSCOT, wood paneling for an interior wall. The term comes from a Dutch word meaning choice oak timber, and was originally used of the superior quality of oak imported into England for interior paneling. Hence it came to be applied to the paneling itself. In England the word is still generally confined to oak paneling, but in the United States it is properly applied to any wooden facing of interior walls. Such paneling was a characteristic feature of the Elizabethan and Jacobean manor house in Eng-

land. In present usage, a wainscot is a lining of wood for the lower portion of the wall only. *See also* MILL WORK.

WAKASHAN, a North American Indian linguistic family occupying the western coast of British Columbia from the Skeena River to the Homathko River, the north and west portions of Vancouver Island and the extreme northwest corner of Washington. The Wakashan peoples were expert canoeists, particularly the Noorka of Vancouver Island who even ventured to hunt whales. Food consisted of fish, land and sea animals and roots and berries. Houses were large communal dwellings in which each family had its own separate fire. They were constructed of huge cedar beams and planks and stood in a long row facing the ocean. In wood-carving the Wakashan were excelled by the Haida and Tlingit. Potlatch was one of the principal institutions and figured heavily in both the religious and social life of the people. Slavery was an accepted part of their social system and headflattening was common among the tribes of Vancouver Island. Descent was chiefly maternal though among certain southern tribes it was reckoned in the male line. Smallpox and vices acquired from the whites have caused their numbers to diminish steadily.

WAKEFIELD, a city in the West Riding of Yorkshire, England, situated on the Calder about 175 mi. northwest of London. It is the focal point for road, rail and water ways of Yorkshire. Once a part of the estate of Edward the Confessor, it is an ancient city submerged to-day in a modern industrial development. Created a bishopric in 1888, its parish church, largely Perpendicular and boasting a crocketed spire 247 ft. high, became a cathedral. There are several curious, half-timbered old buildings surviving, and a 14th century bridge has upon it a small and rare chapel. George Gissing the novelist was a native of Wakefield. To-day it is the chief agricultural market of the West Riding, and has mills, chemical and soap works, iron and various fabric manufactures. Pop. 1921, 53,052; 1931, 59,115.

WAKEFIELD, a town of Middlesex Co., Mass., 10 mi. north of Boston and served by the Boston and Maine Railroad. An attractive residential town of parks and lakes, Wakefield, known chiefly for its rattan and willow furniture and its knit goods and shoes, in 1929 produced manufactures valued at about \$7,000,000. The retail trade in 1929 amounted to \$4,807,961. A settlement was made here in 1639. The present name of the town was adopted in 1868 to honor Cyrus Wakefield, owner of large rattan works and donor of the town hall, but originally it was a part of Lynn, being set off as Reading in 1644. Pop. 1920, 13,025; 1930, 16,318, 25% foreign-born.

WAKE FOREST COLLEGE, at Wake Forest, N.C., an institution for men, was chartered in 1833 as Wake Forest Institute and received its present name in 1838. It is privately controlled and affiliated with the Baptist Church. The college had productive funds in 1931 amounting to \$2,322,214. The library contained 33,000 volumes. In 1931-32 there

were 739 students, and a faculty of 40, headed by Pres. Thurman D. Kitchin.

WAKE ROBIN, a name commonly applied in the United States to various species of *Trillium*, handsome, early blooming plants of the lily family, some of which are also called birthroot. The name is applied in Great Britain to the Cuckoopint, a low perennial of the arum family closely allied to the JACK-IN-THE-PULPIT of the eastern United States which is also sometimes called wake robin. *See* TRILLIUM.

WALAPAI, a North American Indian tribe, dialectically closely affiliated with the Havasupai, both members of the Yuman linguistic stock. They lived formerly on the middle Colorado River from the great bend eastward, their territory extending into the interior of Arizona, including the Hualapai, Yavapai and Sacramento valleys and the Cerbat and Aquarius Mountains, which formed their southern boundaries. They lived mainly by the products of the hunt supplemented by roots and seeds. They are now under the jurisdiction of the Walapai Reservation in northwestern Arizona, but as in the past are given to wandering, roaming now on the Navajo and Hopi reservations.

WALCOTT, CHARLES DOOLITTLE (1850-1927), American paleontologist, was born at New York Mills, N.Y., Mar. 31, 1850. Graduating from Utica Academy, he studied geology and in 1876 became an assistant state geologist. Serving later in the United States Geological Survey, Walcott was appointed to its head in 1894. In the period 1894-1907 he broadened the scope of this body and was instrumental in adding to it the Reclamation and Forestry services and the Bureau of Mines. From 1907 to 1920 Walcott directed and expanded the Smithsonian Institution. A founder of the Carnegie Institution and organizer of the National Advisory Council for Aeronautics, he served both until his death, but these duties did not distract him from his main scientific interest, the discovery and classification of fossils. He surveyed the Paleozoic region of central Nevada and studied the Cambrian formations in the United States and Canada. His published scientific writings number a long list of pamphlets on Cambrian geology and paleontology, and a biography, *Louis Agassiz*, 1907. Walcott died at Washington, D.C., Feb. 9, 1927.

WALD, LILLIAN (1867-), American publicist and sociologist, was born at Cincinnati, Ohio, Mar. 10, 1867; and graduated from the New York Hospital Training School for Nurses. She founded the internationally famous Henry Street Settlement, New York City, a community of trained nurses devoted to visiting work among the poor, in 1893, and created the general service of public-health nursing in the United States. In 1902 she established, also in New York City, the first municipal school-nursing service, and was responsible for the creation of the Federal Children's Bureau, established in 1908 by Congressional enactment. She was one of the organizers of the National Women's Trade Union League, and was

active in national and international movements for public health and welfare. She published *The House on Henry Street* in 1915. Miss Wald was the American delegate to the Woman's International Conference at Zurich in 1919.

WALDEN ("or Life in the Woods"), by HENRY DAVID THOREAU, a beautifully written account in prose of the life which Thoreau led for two years at Walden Pond, near Concord, living on nine cents a day in a cabin built with his own hands. Contemplative and quiet, yet occasionally rising to great heights of poetic ecstasy, this unique work tells, as perhaps no other book has ever done, of woods and streams, birds and animals, and of a keenly sensitive man's responses to them. It was published 1854.

WALDENBURG, a German city in the Prussian province of Silesia about 30 mi. southwest of Breslau near the Bohemian frontier. A mining school is located in Waldenburg. It is near coal mines. There are foundries and machine factories in the city, which also manufactures wire netting, china, glassware and matches. Mentioned in 1426 as a city, it had 16,435 inhabitants in 1905. Pop. 1925, 44,111.

WALDENSES. About 1170 Peter Waldo, a rich merchant of Lyons, reached the conclusion that private ownership of property was contrary to the teachings of Christ. He took a vow of poverty, distributed his wealth among the poor, and set out evangelizing among the people. He gathered many followers, who increased in number and preached in their turn. Thus originated the sect of Waldenses, so called after Waldo. Some writers, however, ascribed the derivation of their name to *vallee*, meaning valley, and called them Vaudois, or Vallenses, valley dwellers. This medieval sect, along with the CATHARS and ALBIGENSES, was the forerunner of the Protestant Reformation. Their break with the Catholic Church was gradual. For centuries, again on account of their social anarchy, they suffered horrible persecutions and were driven from one part of Europe to another seeking refuge. They are now found principally in the Alpine valley regions of Italy, France and Switzerland.

The Waldenses denied the authority of the Pope; declared the consecration and absolution by bad priests to be invalid; held that laymen, and even women, were entitled to preach; and considered tithes and religious endowments unlawful. They were iconoclasts, abolished much of the prevailing ritual connected with Baptism, and held that Extreme Unction was useless.

WALES, a historical division of Great Britain, administratively a part of England. It is a large peninsula on the west of the island of Great Britain, bounded by the Irish Sea and St. George's Channel and bordering the English counties of Cheshire, Shropshire, Hereford and Monmouth. The area is 7,466 sq. mi.

In 1921 the population was 2,205,680. About 8% of the people speak the Welsh language only, 32% are bilingual and the remainder speak English only. The crowding of the inhabitants in the coal fields and the scarcity of population in the agricultural districts

have made the distribution of population very uneven, as may be seen:

County or Shire	Area in Square Miles	Population for 1931
Anglesey	276	49,025
Brecon	733	57,771
Cardigan	692	55,164
Carmarthen	918	179,063
Carnarvon	571	120,810
Denbigh	665	157,645
Flint	254	112,849
Glamorgan	792	1,225,713
Merioneth	659	43,198
Montgomery	797	48,462
Pembroke	615	87,179
Radnor	470	21,314
Total Population 1931, 2,158,193.		

The country is generally mountainous, the chief system being in the north, culminating in Snowdon, a 3,571-ft. peak, the highest in southern Britain. The principal rivers rising in Wales are the Severn, Wye, Usk and Dee. The largest natural lake is Bala, four miles long and about one mile wide.

With its sharp land relief near the western sea, Wales is naturally a land of heavy rainfall, and a belt extending from Snowdon to the hills of the south Wales coal-field gets over 60 in. annually. South Pembrokeshire and south Glamorganshire enjoy more sunshine and receive less rain, but these are almost the only patches, except the valleys near the English border, that get less than 40 in. The temperatures are mild near the sea, especially along the west and south coasts. The highland gets much colder, but snow rarely lies long even on the heights.

At the dawn of modern industrialism, Wales was mainly concerned with farming, growing some corn but being more engaged in the rearing of cattle and, especially, sheep. Less land is now devoted to corn crops, the chief crop being oats. The breeding of horses was formerly of importance but plays a far smaller part, now that mechanical traction has become general. The migration of flocks of sheep between moorland and lowland is still a marked feature of Welsh farming, but now it is not accompanied to any extent by movements of people, other than a few shepherds.

The mineral wealth of the south and the slate quarries of the north have, during the last century, made the country of great economic importance. The counties of Glamorgan and Carmarthen contain enormous quantities of high-grade coal, and, apart from the presence of this mineral, the physical features of south Wales have lent themselves well to industrial development. The distance from mine to port is very short, usually from 5 to 20 mi. with a gradient in favor of the load. CARDIFF is considered the leading coal port of the world. A year before the World War no less than 214,348 persons in south Wales were engaged in coal mining, 42,317 in steel and iron work and 23,042 in general engineering. The post-war industrial position is nowhere more difficult than in southern Wales, mainly on account of the decline

in the coal-export business. The rapid shift to the use of oil, both as steamship fuel and for industrial purposes, the development of water power, the increase of coal and lignite production by countries formerly large users of Welsh coal, and the increased efficiency of boilers have cut sharply into the trade of Wales. All the big towns of southern Wales are engaged in some form of smelting: MERTHYR-TYDFIL specializes in iron; Cardiff in tin-plate; SWANSEA and LLANELLY in copper, zinc and tin-plate. Originally, iron was obtained from the district, and Cornwall supplied copper and tin, but now most ore is imported.

Most of the wealthier inhabitants belong to the Church of Wales, which severed its connection with the Church of England in 1914, a break that was hotly contested. A large majority of the population are nonconformists, being principally Congregationalists, Methodists and Baptists. There are numerous Roman Catholics in the mining area. The center of higher education is the University of Wales, which consists of four colleges at Aberystwith, Bangor, Cardiff and Swansea.

History. The principality of Wales is the result of 15 centuries of consolidation. When the Romans withdrew their legions from Britain in 401, that country, broadly speaking, was Celtic and Christian. The Saxon invaders of England either subdued and absorbed the Celts or drove them westward into Cornwall, Wales and the more northern kingdom of Strathclyde. By the Battle of Dyrham in 577, the Celts in Cornwall were separated from the Celts in Wales. Similarly, the Battle of Chester in 607 separated Wales from Strathclyde. The Welsh, thus isolated, were enclosed further by the Dyke which Offa, King of Mercia, built in 779 from the River Dee on the north to the River Wye.

In 1055 and in later years, Harold, afterwards slain at the Battle of Hastings, attempted the conquest of Wales. And in 1090 William Rufus granted Welsh land to anybody able to take it. In 1277 Llewellyn, the Welsh leader, refused allegiance to EDWARD I but was driven into Anglesea and the mountains around Snowden. Five years later he was killed, fighting on the River Wye. The Statute of Wales, 1284, brought his country under the dominion of England. Edward I was responsible for building the magnificent castles of Conway and Carnarvon where, in 1284 the first Prince of Wales, afterwards Edward II, was born. In 1295 an insurrection led by a Welsh chieftain, Madoc, was suppressed; and a further revolt failed in 1316. The rebellion under OWEN GLENDOWER, beginning in 1400, was more serious. Not until 1536 was Wales finally absorbed into England. Seven years later the principality was divided into counties. A long period of quiet, during which the Welsh language was preserved, has been followed by a remarkable cultural renaissance. During the 18th century, Wales was influenced by the Methodist, Baptist and Congregational movements, and the established or Episcopalian Church ceased to represent the beliefs of the people as a whole. In 1919 the four dioceses of

St. Asaph, Bangor, St. David's and Llandaff were disestablished and reorganized as an Archbishopric of St. Asaph. Two other dioceses, Monmouth and Swansea (with Brecon), have been created. Education has been developed, and the University of Wales, with four colleges conveniently situated at Cardiff, Aberystwith, Bangor and Swansea, has 3,000 students. The remarkable aptitude of the Welsh for music and rhetoric has been displayed at impressive Eisteddfods. Under the leadership of DAVID LLOYD GEORGE, Wales has made a large contribution to British statesmanship. The discovery of coal in South Wales and other industrial developments have drawn into certain districts of the principality a new population in which English blood predominates.

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WALES, PRINCE OF. See EDWARD, PRINCE OF WALES.

WALEY, ARTHUR DAVID (1889-), English translator, was educated at Rugby and at King's College, Cambridge, and for years was assistant keeper in the Department of Prints and Drawings in the British Museum. He edited and translated many works on Oriental art. Waley's publications include *170 Chinese Poems, More Translations*, 1919, *The Temple, Japanese Poetry, The No Plays of Japan*, 1922, *Introduction to the Study of Chinese Painting*, 1923, *The Tale of Genji* and *The Pillow-book of Sei Shonagon*.

WALKER, FRANCIS AMASA (1840-97), American economist, was born at Boston, Mass., July 2, 1840. Graduating from Amherst College in 1860, his law studies were interrupted by the Civil War. In 1869 he was appointed head of the Federal Bureau of Statistics, was superintendent of the census in 1870 and 1880, and in 1871-72 served as Commissioner of Indian Affairs. In 1873 he became professor of political economy at Yale, and in 1881 he was made president of the Massachusetts Institute of Technology, a post which he held until his death. He was president of the American Statistical Association, 1882-97, and of the American Economic Association, 1885-92. His chief book on economics was *The Wages Question*, 1878, which combated the old theory of the "wage-fund." He strongly advocated international bimetalism. He died at Boston, Mass., Jan. 5, 1897.

WALKER, NELLIE VERNE (1874-), American sculptor, was born at Red Oak, Iowa, Dec. 8, 1874. She studied under LORADO TAFT and at the Art Institute, Chicago, where she later became an instructor. She has executed monuments of W. S. Stratton, Sen. Harlan, D. F. Diggins, the Decker family, and Sen. Isaac Stephenson, and has modeled many portrait busts and several large ideal groups. Among her outstanding works are *Her Son*, in the Art Institute, Chicago, and her statue of Chief Keokuk, at Keokuk, Ia.

WALKER, ROBERT JAMES (1801-69), American statesman, was born in Northumberland, Pa., July 23, 1801. He graduated from the University of

Pennsylvania in 1819. He studied law, was admitted to the Pennsylvania bar in 1821, and began practice in Pittsburgh. He was chairman of the Pennsylvania State Democratic Committee in 1823 and three years later he moved to Natchez, Miss., where he continued the practice of law. He was elected a judge of the State Supreme Court in 1828, but declined the office. He denounced South Carolina's nullification (1832-33) and induced the Mississippi legislature to pass a resolution of disapproval of the act. He served in the United States Senate as a Democrat from March 4, 1835 until March 5, 1845 when he resigned to become the Secretary of the Treasury in James Polk's cabinet (1845-49). In the Senate, he opposed the Bank and a protective tariff. He introduced a Homestead Bill, urged the recognition of Texas as an independent state in 1836 and later consistently supported its annexation. He advocated the abolition of the slave trade and pleaded for gradual emancipation of the slaves, freeing his own in 1838. As Secretary of the Treasury, he improved the efficiency of the department and drafted the moderate tariff of 1846, known as the Walker Tariff, which is regarded as the first scientific tariff schedule of the United States. Upon his retirement from the cabinet, he practiced law in Washington, D.C. He was appointed Governor of Kansas Territory April 10, 1857, but his resentment of the practices of the controlling pro-slavery minority led to his resignation in December, 1857. In a hearing before Congress he deplored the tactics whereby slavery was being forced upon the Kansas settlers. He supported the national government during the Civil War, and performed invaluable service in 1863 and 1864 as United States Financial Agent to Europe where he sold large quantities of government bonds, and by discrediting Confederate bonds, partially prevented their sale. He resumed his law practice after the war in Washington, D.C., where he died Nov. 11, 1869.

WALKER, WILLIAM (1824-60), American adventurer, was born in Nashville, Tenn., May 8, 1824. Graduating from the University of Nashville, he studied medicine at the University of Pennsylvania Medical School and for a year in Europe but upon returning to America engaged in newspaper work in New Orleans and San Francisco. In 1853 with a band of followers he attempted the conquest of Sonora, Mexico, but was driven back into the United States where he was tried for violation of neutrality and acquitted. Shortly afterwards in 1855, he led an armed expedition to Nicaragua where he finally succeeded in establishing himself as President. Walker received financial support from a faction which sought to wrest control from Cornelius Vanderbilt of a steamship company which carried passengers from the eastern part of the United States to the west coast by way of Nicaragua. The opposition of Vanderbilt, the armed hostility of neighboring Central American republics, and tropical fevers combined to cause Walker's flight and he surrendered himself to a United States war vessel. Upon his return to the

United States he disregarded his bonds to keep the peace, and in 1857 once more set out for Nicaragua, where he landed only to be apprehended by the commander of a United States war vessel and returned to the United States. In 1860 he decided to essay further Central American operations with Honduras as a base, and upon arriving there he was captured and executed at Truillo, Sept. 12, 1860.

WALKERVILLE, a town of Essex Co., Ontario, Canada, adjoining Windsor, and situated on the Detroit River, near Lake St. Clair, 310 mi. southwest of Toronto. It is less than a mile from Detroit, Mich. with which there is ferry service. The manufactures are chiefly automobiles and automobile accessories. It is a shipping point for the tobacco and grains raised in the vicinity. The international Ambassador Bridge, the nearby Windsor-Detroit Vehicular Tunnel, a well-equipped airport and splendid municipal works make Walkerville notable. Founded in 1890 by Hiram Walker, it was incorporated in 1893. Pop. 1921, 7,059; 1931, 10,105.

WALKING RACES, the competitive sport of travel by foot over road or artificial track. The sport commands its largest following in England, which holds more than a majority of the world's records. Interest in the sport is limited in America, although during 1908-20 the country was represented in the 3500-meter and 10-mile race at the Olympic Games. In the 1908 Olympic, both the 3,500-meter and 10-mile races were won by E. J. Webb, a British policeman. G. H. Goulding of Canada won the 10,000-meter race in the fifth Olympiad, in 46 min., 28½ sec. Italy was victorious at the seventh Olympiad, when Ugo Frigerio defeated the United States and Austria, winning the 3,000-meter race in 13 min., 14½ sec., and the 10,000-meter event in 48 min., 61½ sec. In 1927 the International Olympic Committee voted to discontinue walking events, with the result that the chief walking races are now held in England. In 1930 T. W. Green broke the 1909 record for the London-Brighton walk, covering the 51 mi., 1607 yds. in 8 hr., 2 min., 55 sec. The 1-mile world's record is 6 min., 25¼ sec., established in 1910 by the aforementioned Goulding. All the other records up to the 25-mile walk are held by England, except the 7-mile event, also held by Goulding, 50 min., 40¼ sec., established in 1915.

WALKÜRE, DIE, an opera by RICHARD WAGNER, one of a cycle of four music-dramas; *see* RING OF THE NIBELUNG.

WALLABY, a name given to certain small Australian kangaroos; a few also inhabit New Guinea. From the great KANGAROO of the plains they differ in various respects, some being found only in brushy country, others living only among trees, and one group (*Dendrolagus*) living only in trees, a change of habit to which their shortened hind legs are adapted.

WALLACE, ALFRED RUSSEL (1823-1913), English naturalist, was born at Usk, Jan. 8, 1823. After teaching for a few years and making private botanical studies he and a fellow naturalist H. W.

BATES undertook an expedition to the Amazon. Wallace returned a few years later losing his entire collection but saving his notes when his ship burned. These and his *Travels on the Amazon and the Rio Negro*, 1853, gave him a scientific reputation and obtained financial support for a trip to the East Indies in 1854 where he remained for eight years. While in the east, Wallace first observed the sharp division of the Malay Archipelago into an Australian section and an Asiatic section by the straits of Macassar and Lombok. A few years later while lying sick of fever at Ternate in the Moluccas it suddenly occurred to Wallace that the change of animal species was caused by the survival of the fittest. He immediately drafted a brief essay upon this theory and forwarded it to C. R. DARWIN, requesting that it be read before the Linnean Society. Darwin read his *On the Tendency of Varieties to Depart Indefinitely from the Original Type* and found that it embodied his own theories of natural selection. Wallace's paper and Darwin's were read before the Linnean Society on the same day, July 1, 1858. Wallace returned to England in 1862 and continued writing upon scientific and general topics. He never entirely agreed with Darwin's mechanics of evolution and became a believer in spiritualism, wrote against vaccination and in favor of Single Tax. He died at Broadstone, England, Nov. 7, 1913.

WALLACE, EDWARD WILSON, (1880-) Canadian educator, was born at Metuchen, N.J., Nov. 2, 1880. He was graduated from Victoria College, University of Toronto, 1904 and 1906, and from Columbia University, 1921. In 1906 he went to West China as a Methodist missionary, and six years later was appointed professor of educational administration in the West China Union University. He continued prominent in education work in China until he became president of Victoria University in 1930.

WALLACE, JOHN FINDLEY (1852-1921), American civil engineer, born at Fall River, Mass., in 1852. He graduated at the University of Worcester in 1882, but had previously had practical experience, having been employed in Mississippi River and railroad work. Wallace was engineer in a variety of enterprises and the first American chief engineer on the Panama Canal, 1904. From 1906 to 1917 Wallace was president and chairman of the board of directors of Westinghouse, Church, Kerr & Company, designed many terminals and was the adviser to many corporations. During the World War he was a member of the Transportation Committee of the National Petroleum Advisory Board. He died July 3, 1921.

WALLACE, LEW or LEWIS (1827-1905), American soldier and novelist, was born at Brookville, Ind., Apr. 10, 1827, and studied law in Indiana. He served as an officer in both the Mexican War and the Civil War, especially distinguishing himself in the latter conflict at the battles of Shiloh and at Corinth. His action at Monocacy, Pa., is generally conceded to have saved Washington from falling to the Confederate forces. After the war Gen. Wallace served on two

courts of inquiry, and was a member of the court which tried the Lincoln conspirators. In 1865 he resumed his law practice in Indiana. As a novelist, he is known for his glamorous historical romances, particularly *BEN HUR*; his other works include *The Fair God*, 1873, and *The Prince of India*, 1893. Gen. Wallace acted as Governor of New Mexico Territory in 1878-81, and as Minister to Turkey in 1881-85. He died at Crawfordsville, Ind., Feb. 15, 1905.

WALLACE, SIR WILLIAM (c. 1270-1305), Scottish national hero. Outlawed at an early age, he organized a rebellion against the English, who sent an army to subdue him. After early reverses, he won the battle of Stirling in 1297, sweeping his enemies from Scotland. Wallace and his men raided several counties in northern England. When Edward I, the English king, returned to Scotland with an army, many of Wallace's supporters deserted him, and he was defeated at Falkirk in 1298. Wallace retired northward, and afterward crossed to France to ask aid from the French king. A price having been put on his head, he was treacherously delivered into the hands of Edward's agents. Taken to London, he was found guilty of treason, and executed on Aug. 22, 1305.

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WALLACHIA. See RUMANIA, HISTORY OF.

WALLACK, LESTER (1820-88), American actor, was born at New York City, Jan. 1, 1820, son of J. W. Wallack, also an actor. His first appearance was as Angelo in *Yortesa the Usurer* by N. P. Willis. He played many parts in light comedy, including Doricourt, Rover, Claud Melnotte, Wildrake, Captain Absolute, Sir Charles Surface and Sir Benjamin Backbite, and was one of the leading comedians in the American theater. He wrote two successful plays, *Rosedale* and *The Veteran*. He married a sister of Sir John Millais, president of the British Royal Academy. His father, James William Wallack, founded Wallack's Theatre, New York City, an institution which endured 63 years, and which Lester Wallack directed during 1864-87, presenting many American and English stars. His *Memories of Fifty Years* appeared posthumously in 1889. He died at Stamford, Conn., Sept. 6, 1888.

WALLAS, GRAHAM (1858-1932), English educator and author, was born in Sunderland, May 31, 1858. He was educated at Shrewbury School, and Corpus Christi College, Oxford. Wallas was lecturer at the London School of Economics, 1895-1923, a member of the Senate of London University, 1908-28, and held the chair of political science, 1914-23, when he became professor emeritus. He was Lowell lecturer at Boston in 1914, and Dodge lecturer at Yale in 1919. His writings include *Human Nature in Politics*, 1909, and *Our Social Heritage*, 1921. Wallas died in Cornwall, England, on Aug. 10, 1932.

WALLAWALLA, a North American Indian tribe speaking a distinct dialect of the Shahaptin linguistic stock, closely affiliated with the Nez Percé. They

lived formerly on the lower Wallawalla River and the eastern bank of the Columbia from the Snake River almost to the territory of the Umatilla, in Washington and Oregon. Now they are on the Umatilla Reservation, interbred with Nez Percé, Umatilla and Cayuse.

WALLA WALLA, a city in southeastern Washington, the county seat of Walla Walla Co., situated on Mill Creek, 162 mi. southwest of Spokane. It is served by buses and two railroads. There is an airport. The region produces wheat, fruit and vegetables. Walla Walla is a trading center with some manufactures, including flour and meat products. The industrial output, 1929, amounted approximately to \$3,000,000; the retail business was valued at \$14,486,231. Lewis and Clark visited this site in 1805-06. A fort was built in 1857, and the city was laid out in 1859; it was incorporated as a city in 1862. Walla Walla is the seat of Whitman College, Walla Walla College and a United States Veterans' Hospital. Pop. 1920, 15,503; 1930, 15,976.

WALL BOARD having a core of Gypsum (see also GYPSUM PRODUCTS), with or without fiber, and surfaced with paper or other fibrous material firmly bonded to the core, are used without plaster coatings as a finish on walls, ceilings and partitions on the interior of buildings. These wall boards are usually $\frac{3}{8}$ inch thick and of various widths and lengths.

WALLENSTEIN, ALBRECHT WENZEL EUSEBIUS VON (1583-1634), Duke of Friedland and Mecklenburg, and Prince of Sagan, Austrian general, was born at Herrmanic, Bohemia, Sept. 1583. He was educated by the Jesuits and at the Universities of Altdorf, Bologna, and Padua. At the outbreak of the Bohemian revolt in 1618 (the start of the THIRTY YEARS' WAR), he offered a regiment to the Emperor and when order was restored he was permitted to purchase large tracts of the confiscated lands of the defeated Bohemians. He was made duke in 1623 and prince the following year. In 1625 he came to the Emperor's aid a second time, raising an army of 20,000 men to crush the threat of the Lower Saxon League, and as field-marshal defeated Mansfeld at Dessau the following year. He seized Silesia in 1627 and forced the Danish king to leave Germany. Removed from his command in 1630 he went into retirement at the invitation of the Emperor in 1632 to retrieve the imperial fortunes. He recovered Bohemia from the Saxons and defeated the Swedish Gustavus Adolphus at Nuremberg and himself suffered defeat in the ensuing BATTLE OF LUTZEN, despite the fact that Gustavus was killed early in the action. Suspicious of his motives, the Emperor Ferdinand II outlawed him and relieved him of command whereupon Wallenstein sought to seize power and secure control of the Empire. Unable to cope with him in the field Ferdinand plotted his assassination and had him murdered with four of his generals at Eger, Bohemia, Feb. 25, 1634.

WALLER, EDMUND (1606-87), English poet and parliamentarian, was born at Coleshill, Hertfordshire, Mar. 3, 1606, and educated at Eton and Cam-

bridge. He entered Parliament at 16. On May 31, 1643, he was arrested by order of Pym for his part in the "Waller" plot against Parliament, and was heavily fined, imprisoned for two years and banished. While in France he first published his poems. In 1652 the Commons permitted his return, and he gratefully addressed a panegyric to Cromwell, 1655. On the Restoration, however, he welcomed Charles II in verse, and on the King's complaint that the poem was inferior to the one he wrote to the Protector replied that "Poets succeed better in fiction than in truth." His *Divine Poems* appeared in 1685. Waller revived the HEROIC COUPLET, which JOHN DRYDEN and ALEXANDER POPE were to perfect, and wrote some flawless lyrics such as *Go, lovely rose*. He died at Beaconsfield, Oct. 21, 1687.

WALL-EYED PIKE, an excellent food and game fish of the perch family common in fresh waters in eastern North America, so called because of its prominent glassy eyes. See PIKE PERCH.

WALL FERN, one of the various names given to the common POLYPODY, a small fern which often grows in the crevices of rocks and walls.

WALLFLOWER (*Cheiranthus Cheiri*), a hardy perennial of the mustard family, long widely grown in gardens for its bright yellow or brown-purple, very fragrant flowers blooming in early spring. It is a native of south Europe with numerous forms in cultivation. It grows about 2 ft. high with narrow, pointed leaves, large, showy flowers, an inch in length, and a long, four-angled seed pod.

WALLINGFORD, a town and borough of New Haven Co., in central Connecticut, situated about 15 mi. north of New Haven, on the Quinnipiac River. The New Haven Railroad is the chief means of transportation; Wallingford Airport is municipally owned. The town is a busy industrial center, manufacturing silverware and other metal products, light hardware and rubber goods. The retail trade in 1929 amounted to \$5,163,521. It is located in a fruit-growing area. Wallingford was founded in 1670 and incorporated in 1853. Pop. of borough 1920, 9,648; 1930, 11,170; of town 1920, 12,010; 1930, 14,278.

WALLINGTON, a borough of Bergen Co., N.J., situated 9 mi. northwest of Jersey City on the east of the Passaic River, navigable at this point, and facing Passaic, N.J. It is served by electric trolleys and buses and connections with the Erie Railroad. It is an industrial community, the varied products of which include dyes, millwork, insulation, handkerchiefs, lacquers and solvents. Pop. 1920, 5,715; 1930, 9,063.

WALLOON LITERATURE, a body of writings in the Walloon language, a Romance dialect spoken in the southern part of Belgium. See BELGIAN LITERATURE.

WALL PAPER, an inexpensive substitute for hangings of brocade, tapestry and leather, invented sometime after the discovery that type could be cut on wood blocks and printed, at first a by-product of letterpress printers.

In France during the 16th century a kind of paper

known as domino was perfected in which wood block designs were stenciled with tempera colors. No attempt was made to match the geometric patterns of domino papers until Jean Papillon solved the problem of continuous or matched designs about 1688. This was the method in general use in French factories, when at the beginning of the 17th century the founding of the Dutch, French and English East India Companies led to the popularity of Chinese hand-colored papers.

Fast on the heels of the oriental furor came the flock paper invention, by which finely chopped wool, blown upon a wet varnish, was made to simulate brocade or damask. The use of flock papers spread from France to England, and by 1750 back to France. The style was adopted by the French Court, and when an English factory was established near Paris the French retaliated by inventing a process to simulate silk. A change came over French wall paper during the second half of the 17th century when J. B. Réveillon began to execute the designs made for him by artists of the day. Réveillon's imitation of painted panels are among the most beautiful papers ever made.

The figure of greatest interest in the history of English wall paper is John Baptist Jackson, whose Battersea factory flourished about 1754. Jackson's designs include landscape panels, reproductions of old masters and grisaille statues, engravings of Rome and the famous Venetian prints commissioned by Horace Walpole for Strawberry Hill.

In 1799 Nicholas Louis Robert of Essones invented the process for producing continuous rolls which made possible further developments in scenic papers. The Zuber establishment at Rixheim in Alsace, founded in 1790 and still in existence, produced in *Scenic America* and *The War for Independence* two of the most popular of the panorama papers imported to the Colonies, while in 1804-5 the Parisien Dufour made his reputation with a picture paper depicting the adventures of Captain Cook. Dufour's masterpiece, Cupid and Psyche, from a design by Lafitte, appeared in 1816. His *Bay of Naples* and *Monuments of Paris* still come to light occasionally on the walls of New England houses.

In 1739 Plunket Fleeson opened the first American manufactory in Philadelphia, and with the setting up of the first color-printing machine in 1844 wall paper entered upon the great era which lasted until 1900. The recent revival of interest in early American decorations has led to a study of Colonial wall treatments and a search for old papers in an attempt to revive both the taste and technique of pre-Victorian days.

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WALLS, in mining, refer to the boundaries of an ORE DEPOSIT or body. In some cases, the ore comes to an abrupt end on either side, against barren rock, and then the walls are quite definite. In others, the ore gradually decreases in grade towards the periphery of the deposit, when the "walls" are determined only

by the point at which mining ceases to be profitable. See also PROSPECTING; MINING, METAL.

WALL STREET, a thoroughfare running from east to west across the lower end of Manhattan Island, from the East River to Broadway, about one-third of a mile in length. It has been the center of the financial life of New York since the very beginning of the money market. Its name, which has become a synonym for the whole group of financial institutions, is derived from the wall or stockade built by early Dutch settlers about the middle of the 17th century to protect them from raids of Indians and English. The growth of the village soon passed this barrier, and what was once the northern boundary of the city is now looked upon as the extreme southern end.

After the Revolution, when the financial history of New York was just beginning, Wall Street was a fashionable residential section. The Bank of New York established its office there in 1784, the Bank of the Manhattan Company in 1787, the branch of the first BANK OF THE UNITED STATES was located there in 1791. When the funding of the debts of the states into a Federal issue and the appearance of government bonds laid the foundations for a security market, stockbrokers began to assemble there, at first under a legendary buttonwood tree and later in offices. A formal constitution was adopted by the Exchange in 1817, and it moved into the new Merchants' Exchange building in 1827. It was not until 1865 that a separate building was erected. The Curb Exchange was for many years on Broad Street just south of Wall Street.

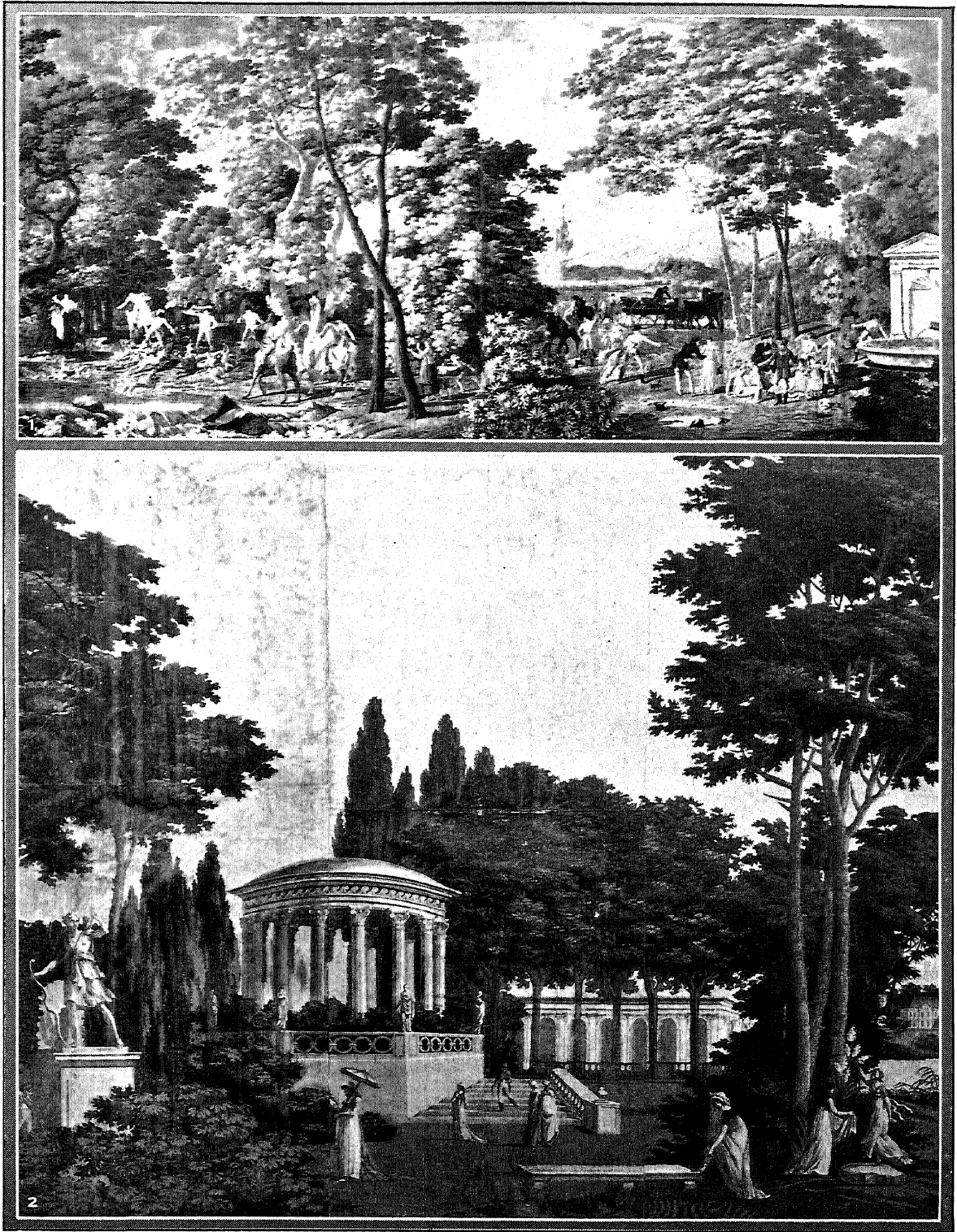
The crowding of Wall Street resulted very early in the erection of high buildings to accommodate the offices of bankers and brokers. Until high buildings began to be erected farther uptown also, the neighborhood of Wall Street contained nearly all of the skyscrapers which made the skyline of New York famous.

The influence of Wall Street and its environs upon the financial life of the nation can hardly be overestimated. The largest commercial banks, the great private bankers and investment houses, the important insurance companies, the large corporations and the STOCK EXCHANGE, govern the money market by the sheer force of their combined properties. Interest rates are established there, security quotations and foreign exchange rates are made and new issues are put into the market. The magnitude of its operations makes Wall Street one of the most important money markets of the world.

B. H. B.

WALNUT, an important genus (*Juglans*) of valuable timber, nut bearing and ornamental trees of the walnut family. There are 11 species together with several varieties, races and natural hybrids native to temperate North America, the West Indies, western South America and Asia. Of these, six occur in North America. They are mostly large trees with furrowed, scaly bark, dark, fine-grained, very durable wood, and stout branchlets bearing large pinnate leaves

WALLPAPER

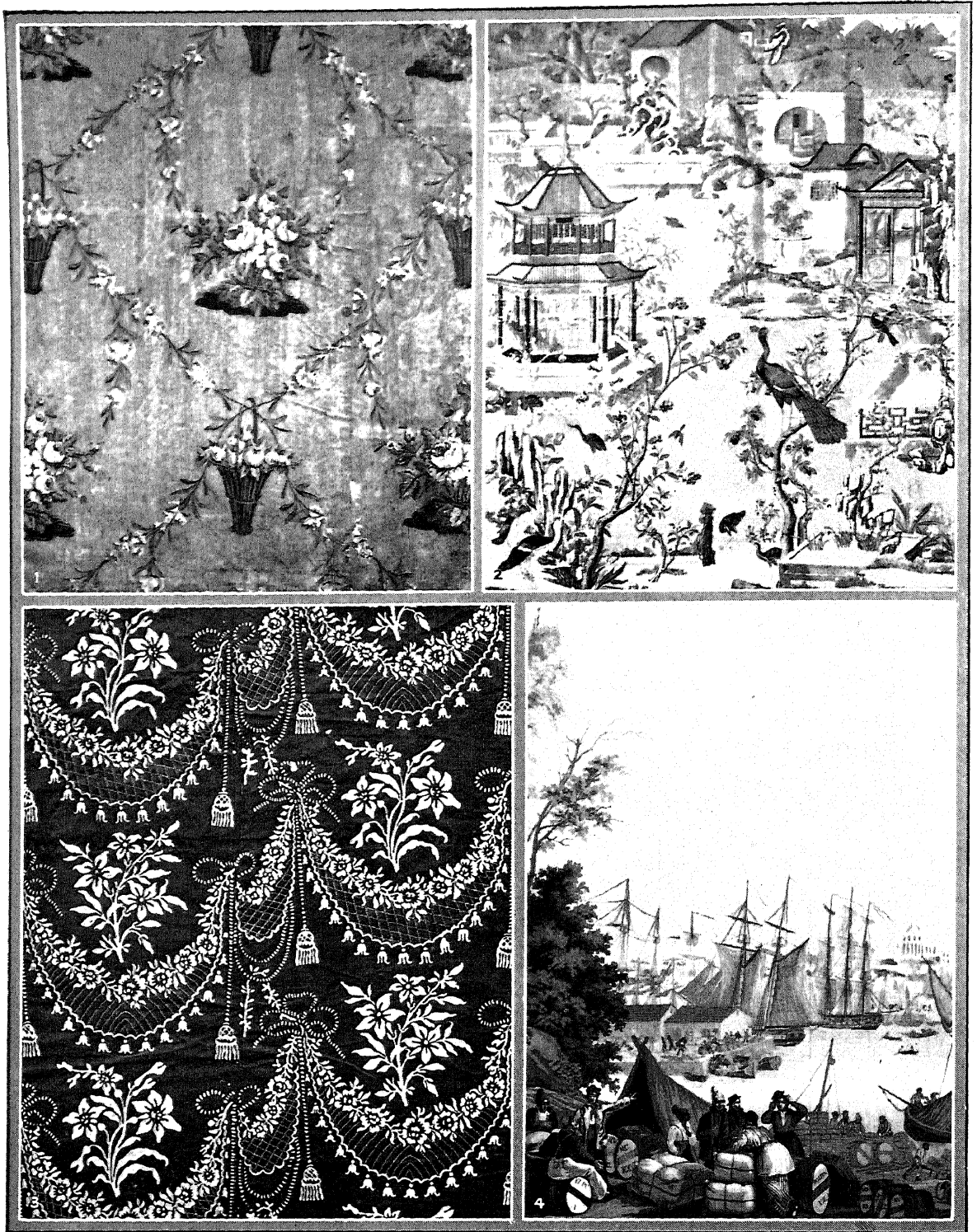


COURTESY METROPOLITAN MUSEUM OF ART

FRENCH PICTORIAL WALLPAPERS

1. *Chasse à course*, Jacquemart et Bénard, Paris. 19th century.
2. Decorative landscape with figures, by Arthur et Robert, Paris, 1781-1811.

WALLPAPER



1. 2. 3. COURTESY METROPOLITAN MUSEUM OF ART; 4. A. L. DIAMANT & CO., NEW YORK

EXAMPLES OF FINE WALLPAPER DESIGN

1. Decorative floral paper by Reveillon (1765-89). 2. Early 18th century Chinese wallpaper, hand-painted and mounted on linen. 3. Conventional design in a Rixheim paper.

Late 18th century. 4. A French conception of Boston Harbor in the early 'eighties, from the series "Scenic America," made by Zuber of Rixheim.

of many leaflets emitting a balsamic odor when bruised. The inconspicuous flowers, which appear after the unfolding of the leaves, are of two kinds, the staminate borne in slender lateral clusters and the pistillate in short terminal spikes. The large, globose, ovoid or somewhat pear-shaped fruit consists of a thick fleshy husk surrounding a hard-shelled, more or less ribbed and wrinkled, two-valved nut containing a sweet, oily, edible seed.

Economically the most valuable species is the Persian walnut (*J. regia*), commonly called English walnut, cultivated since ancient times for its pleasantly flavored nuts now a staple article of commerce. The tree, a native of southeastern Europe and temperate Asia, is extensively cultivated in mild climates, especially in Mediterranean countries, China and southern California. Hardy races are grown successfully as far north as New York.

The most important American species is the black walnut (*J. nigra*), a large forest tree often 100 ft. high with a trunk 4 to 6 ft. in diameter, native to rich bottom-lands from western Massachusetts to Minnesota southward to Florida and Texas. Black walnut timber is the most valuable North American hard wood; in many parts of its range the tree has been so extensively cut for lumber that it has become rare. In 1930 the total cut of walnut lumber in the United States amounted to 36,305,000 ft., valued at the mill at \$3,657,728.25.

Besides the butternut (*J. cineria*) of the eastern states the North American species include the California walnut (*J. californica*), the Hind's walnut (*J. Hindsii*), the rock walnut (*J. rupestris*) and the nogal walnut (*J. major*), all small trees found in the Southwest. A. B. J.

Cultivation. Success in walnut growing depends largely on mild climate, availability of water and rich alluvial soil well-supplied with humus. Clean culture during the summer with cover crops to maintain the humus supply are the usual practice. Where irrigation is necessary water is generally applied by the furrow system, five or six times a season, a sufficient amount each time to soak the soil at least 6 ft. deep so as to reach all the roots. The last irrigation is given within two weeks of harvest to make the shucks open and allow the nuts to fall, otherwise they may stick to the nuts and increase the cost of harvesting. The leading varieties growing in the Pacific States are Eureka, Placencia, El Monte, Prolific and Franquette. The last named, the Rush and the Mayette are grown in home grounds in eastern United States as far north as the Niagara fruit belt along the shore of Lake Ontario.

The total production of English walnuts in the United States increased from 59,840,407 lbs. in 1919 to 78,159,951 lbs. in 1929. In the latter year California produced 96.5% and Washington 3.2% of the total crop. M. G. K.

WALNUT CANYON, a national monument in central Arizona comprising a tract of 960 acres which was set aside on Nov. 30, 1915 under the jurisdiction

of the Department of Agriculture. The monument contains prehistoric cliff dwellings of exceptional scientific and popular interest. Instead of the usual communal type of cliff dwelling, these houses seem to have been built for separate families and have from six to eight rooms each. They are built under the overhanging walls of the cliff and use projecting limestone ledges for foundations. Walnut Canyon is reached by a good automobile road. It is approximately 9 mi. southwest of Flagstaff, Ariz., which is on the National Park-to-Park Highway and the Atchison, Topeka and Santa Fé Railroad.

WALPI, one of the six villages of the Hopi in northeastern Arizona, situated at the southern end of the east mesa. The first site established by ancestral clans of the founders of Walpi was situated on the lowest terrace on the northwest side of the mesa. This village was moved in 1629 to a higher terrace where the ruins of a mission chapel may still be seen. Shortly after the Pueblo Rebellion in 1680 the present site was established.

WALPOLE, HORACE (1717-97), English statesman, author and man of letters, son of Sir Robert Walpole, the English statesman, was born in London, Sept. 24, 1717. He was educated at Eton and Cambridge and made the continental Grand Tour. Returning in 1741 he entered Parliament where he sat continuously for 27 years. Walpole's renown rests upon his diaries, memoirs and correspondence, which are valuable to students of the latter half of the 18th century because of the graphic detail with which they picture life, politics and personalities of his time. Walpole is especially noted for his letters which have retained their interest and vitality to the present day. A noted antiquary, he was the author of *The Castle of Otranto*, a "Gothic" novel which had considerable influence on later writers. Important also are his memoirs of the reigns of George II and George III. His famous home, the unique Strawberry Hill, at Twickenham, was a center of learning, literature and fashion. In 1791 Walpole succeeded to the Earldom of Orford; he died in London, Mar. 2, 1797.

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WALPOLE, HUGH (1884-), English novelist, was born in 1884, the son of Rt. Rev. G. H. S. Walpole, Bishop of Edinburgh. He was educated at King's School, Canterbury, and Emmanuel College, Cambridge, and during the World War served with the Russian Red Cross. His first novel, *The Wooden Horse*, appeared in 1909 and, among others, was followed by *Maradick at Forty*, 1910, *The Duchess of Wrexhe*, 1914, *The Cathedral*, *Portrait of a Man with Red Hair*, *Jeremy*, 1919, *Jeremy at Crle* and *Rogue Herries*, 1930, and *Judith Paris*, 1931. Walpole is also the author of a study of JOSEPH CONRAD, 1916, and of a biography of ANTHONY TROLLOPE, 1928.

WALPOLE, SIR ROBERT (1676-1745), 1st Earl of Oxford, English statesman, was born at Houghton, Norfolk, Aug. 26, 1676. He was educated at Eton and Cambridge, and entered public life in 1701, as a Whig member of Parliament from Castle Rising.

His attention to parliamentary proceedings and his practical politics won him the Whig leadership, and in 1708 he was appointed Secretary of War. In 1712 he was expelled from Parliament on Tory charges of malfeasance which were later disproved. He remained in prison a year, and on his release was re-elected to Parliament, and recovered the party leadership. George I made him army paymaster in 1714, and a few months later he was appointed Chancellor of the Exchequer and First Lord of the Treasury. Walpole resigned in 1717, but returned to public office in 1720, the next year resuming his post at the head of the Exchequer. For the ensuing 21 years, he controlled the ministry, steadfastly holding to the policies of stable domestic finance, and freedom from entangling alliances. Eventually his influence was weakened by riots over tax frauds, the tobacco, wine, and gin imposts, and by the Spanish War of 1739. His ministry was defeated in 1742. Upon his resignation he was created Earl of Oxford. Walpole's practicality in party government and his financial skill had the two-fold result of firmly establishing the Hanoverian house on the throne, and of introducing the policy of free trade, which was responsible in large part for England's later prosperity. He died at London, Mar. 18, 1745.

WALPOLE, a town of eastern Massachusetts, in Norfolk Co., is situated about 19 mi. southwest of Boston, on the Neponset River and Federal Highway I. The New York, New Haven & Hartford Railroad and bus lines afford transportation. Walpole is chiefly a manufacturing center, with paper, hospital supplies, automobile brake linings, leather and asphalt-roofing the principal products. It also has machine shops and bleacheries. Walpole was incorporated in 1724. Pop. 1920, 5,446; 1930, 7,273.

WALPURGIS, ST. (8th century), also known as Saint Walburga, Saxon princess and missionary to Germany, was born in Sussex during the first half of the 8th century. She was the daughter of St. Richard, a Saxon prince in Wessex, and her brothers were the saints Willibald and Winebald. Upon the invitation of St. Boniface she went with her brothers to Germany and devoted the rest of her life to the conversion of the heathen Germans. She became abbess of the nunnery she had founded in Heidenheim, Eichstatt, where she died about 776. The oil that flowed from the spot which is said to contain her relics has been called Walpurgis oil and is alleged to be endowed with miraculous curative properties. It is worth noting that Cardinal Newman cites this fact as one of the miracles that are fully credible. Saint Walpurgis is also invoked against magic and the black arts; Goethe alludes to this in the Walpurgis-Nacht dance of his *Faust*. Her day is celebrated on May 1 and thus substitutes perhaps for the previous pagan festival held then.

WALPURGIS NIGHT, according to a medieval German superstition, the night between Apr. 30 and May 1, when the witches hold a fantastic congress in the Hartz Mountains. St. Walpurgis, Walpurga or

Walburga, the sister of SS. Willibald and Wunnibald, was an 8th century missionary from Sussex, England, who founded the nunnery at Bischofsheim, was abbess of the double monastery of Heidenheim, and whose stone tomb at Eichstatt, where the saint was buried, exuded an oil supposed to have remarkable religious and medicinal virtues. The Walpurgis legend is used by Goethe in *Faust*.

WALRUS, an arctic sea-mammal closely allied to the seals. Two species exist, the Atlantic walrus (*Odobenus rosmarus*), and the Pacific walrus (*O. divergens*), the latter having the larger tusks. Both are of huge size, old males sometimes measuring 10 to 12 ft. in length and weighing 2 or even 3 tons. The females are smaller. In form the obese body is somewhat bearlike; the yellowish hide is thick, wrinkled and almost hairless; the massive limbs end in flipper-like feet, powerful in swimming and enabling the animal to creep about on land. The head is blunt and broad, its muzzle set with course bristles, and from the upper jaw point downward two long ivory canine teeth or tusks. With these tusks the animals dig the clams on which they mainly subsist, and fight each other and enemies.

Walruses spend their lives in the Arctic seas, moving about in small mixed herds, usually not far from shore. The eastern species comes south as far as Labrador and Spitzbergen; the western one into Bering Sea. They rest on lonely reefs, and resort to the mainland only for a fortnight or so in mid-summer to produce their young. Their numbers are rapidly decreasing, for they yield valuable hides, oil and ivory, useful to the Eskimos and marketable by white hunters. See SEAL.

E. I.

WALSALL, a market town of Staffordshire, England, lying upon a ridge at the northern boundary of the Black Country, on a tributary of the Tame, about 120 mi. northwest of London. Though of modern appearance, in the 10th century it belonged to the church of Wolverhampton, and by 1390 boasted a merchant guild. With a scattering of other ancient structures, the 15th century Church of St. Matthew survives, and a Tuesday market granted in 1417 is still held. Since the 17th century Walsall has been celebrated for its hardware, and the manufacture of leather goods and gloves is also carried on. Coal, ironstone and limestone are abundant in the neighborhood and there are foundries. Pop. (of county borough) 1921, 97,567; 1931, 103,102.

WALSENBURG, a city in southeastern Colorado, the county seat of Huerfano Co., situated 50 mi. southwest of Pueblo; served by two railroads. The city is situated in a coal-mining and irrigated farming region on the plains at the foot of the San Isabel Mountain. To the north and southwest are great national forests. Pop. 1920, 3,565; 1930, 5,503.

WALSH, MATTHEW J. (1882-), American clergyman and educator, was born in Chicago, Ill., May 14, 1882. He was graduated at Notre Dame University in 1903 and the same year joined the order of the Holy Cross. In 1907 he was ordained a

Roman Catholic priest. Having made a special study of European history, he was chosen professor of history at the University of Notre Dame in 1907. He served in this capacity until 1922 and in 1922-28 was president of the institution. During the World War he was a chaplain overseas.

WALSH, THOMAS JAMES (1859-), American legislator, was born in Two Rivers, Wis., June 12, 1859. He studied law at the University of Wisconsin, and began to practice in 1884 at Redfield, S.D. In 1890 he moved to Helena, Mont., where he became active in Democratic politics. He was sent to the United States Senate in 1913, where he supported the legislation program proposed by President Wilson. He became a leading and influential member of the Democratic group in the Senate, and was reelected in 1918, 1924 and 1930. In 1924 and 1932 he was permanent chairman of the Democratic National Conventions at New York and Chicago. In 1924 he conducted a vigorous investigation of government oil leases in connection with the Teapot Dome property. He has been a prominent member of the Senate foreign relations committee in later years.

WALSINGHAM, SIR FRANCIS (c. 1530-90), English statesman and diplomatist, was born around 1530. In 1543 he entered St. John's College, Cambridge, and in 1555-56 was a member of the faculty at Padua. Elected to parliament from Bambury, he became a member of the party of Cecil and was appointed ambassador to France in 1570. On his return he was made secretary of state, an office he filled with extraordinary ability and distinction. Read says of him, "He stood at the very center of the royal administration and for over seventeen years was the most active agent of the Queen in every department of state except those of justice and finance." In 1578 he was sent on a special embassy to the Netherlands, in 1581 again to France and two years later to Scotland in connection with the difficulties over Mary Queen of Scots who found in him a determined enemy, and at whose trial he served as one of the Commissioners. He died Apr. 6, 1590.

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WALTER, THOMAS USTICK (1804-87), American architect, was born in Philadelphia, Sept. 4, 1804, and there achieved his first fame with his design for Girard College (1833). This building, which was finished in 1847, was declared to be the finest classic structure in the United States. Walter was then appointed architect to the United States Government, and in 1851-65 made the extensions to the Capitol at Washington, building the Dome, and completing the structure in its present form. He also planned the extensions to the Treasury, Post Office, and Patent Office Buildings. He was one of the founders of the American Institute of Architects. He died in Philadelphia, Oct. 30, 1887.

WALTHAM, a city in Middlesex Co., eastern Massachusetts, on the Charles River about 10 mi. northwest of Boston, served by trolley lines and the

Boston and Maine Railroad. Its picturesque site among wooded hills embraces parts of the Beaver Brook and the Charles River reservations. It is a busy industrial center, noted chiefly for the making of watches. Other industries include cotton and furniture manufacturing. In 1929 its manufactures were valued approximately at \$18,000,000; the retail trade amounted to \$19,835,763. It is the seat of the Massachusetts school for the feeble-minded. The first power-mill for cotton cloth making was built in Waltham in 1814. Waltham was incorporated as a town in 1738 and chartered as a city in 1884. Pop. 1920, 30,915; 1930, 39,247; about 26% foreign-born.

WALTHER VON DER VOGELWEIDE (c. 1165-c. 1230), Middle High German minnesinger, was born probably in Austria, about 1165. Of a noble but poor family, he spent his early years in the court of Duke Frederick the Catholic in Vienna, where he learned the art of Minnesong under Reinmar der Alte Walther. After 1198 he became a wandering singer, visiting various courts in Germany, Austria and adjoining countries. It is thought that he took part in Frederick II's Crusade of 1227-28. *Under der linde an der heide* is perhaps the best known of his poems, which include love songs, religious songs and political songs or *Spruche*. Walther is generally considered the greatest German lyric poet before Goethe. He died on a fief given him by Frederick II near Würzburg sometime after 1227. See also GERMAN LITERATURE; MINNESINGER.

WALTON, IZAAK (1593-1683), English writer, was born at Stafford, Aug. 9, 1593. He kept a shop in London, but when the Civil War broke out, returned to Stafford, where he had bought some property. In 1650 he was back in London, and the rest of his life was unhurried and agreeable. **THE COMPLETE ANGLER**, Walton's most noted work, appeared in 1653. It is among the best known books in the English language. Walton also wrote the biographies of several friends, including Donne, Hooker, George Herbert and Henry Wotton. He was fond of clerical society and his first wife was a collateral descendant of Archbishop Cranmer, his second wife the sister of a later Bishop of Bath and Wells. Walton died at Winchester, Dec. 15, 1683.

WAMPANOAG, a tribe of North American Indians speaking a dialect of the Algonkian linguistic stock. They were one of the principal tribes of New England and occupied the peninsula on the eastern shore of Narragansett Bay and the adjacent region in what is now Bristol co., Mass. Their chiefs ruled all the country from Narragansett Bay and the Pawtucket River east to the Atlantic including Nantucket and Martha's Vineyard. On the arrival of the English at Plymouth, Massasoit, their chief, made a treaty of friendship which he kept faithfully until his death. His son Philip instigated King Philip's War in 1675 which in two years resulted in the practical extermination of the tribes involved.

WAMPUM, the shell beads of the North American Indians used by them for money. Wampum was

made into single strings usually fastened together in bunches or strands, into belts, sashes, scarves and was also used by important persons in a tribe to adorn moccasin ties and other forms of personal adornment. It was made from several kinds of shells including various species of the common round or hard-shell clam, the poquauhaug (*Venus mercenaris*), usually contracted to quahog or quahog, and called hens by the English; the periwinkle; the whelk; fresh-water shells of the genus *Unio* and, on the Pacific Coast, the Dentalium, abalone, scallop and olivella. It was always of two kinds, white wampum and black wampum. The black was the more valuable, usually valued at two to one of the white in exchange. In New England and New York the white variety was made from the central core of columella of the whelk; black wampum varied from pale violet to the more valuable dark rich purple. In form the beads were cylindrical, being from about $\frac{1}{8}$ to $\frac{3}{16}$ of an inch in diameter and from $\frac{1}{8}$ to $\frac{7}{16}$ of an inch in length. The making of the beads required a high degree of skill and patience. Before the introduction of European drills they were painstakingly bored with flint stones and ground to the smoothness of glass. Poorly ground or "counterfeit" wampum became a great problem and its value was lessened by statute. Wampum circulated as money in New England throughout the 17th century and had a standard value among whites as well as Indians not only in merchandise but in currency. It circulated with silver in Connecticut as late as 1704 and was also much used in Virginia and the Carolinas and on the Pacific Coast. Among the Indians, in addition to being a medium of exchange wampum had many uses and a wide variety of significances. In general, white was an auspicious color; black inauspicious. When used ceremonially, white wampum indicated peace, health and prosperity; black wampum indicated hostility, war, sorrow, death and mourning. Tribes making peace customarily exchanged strings of white wampum and when one of these tribes wished to declare war against the other, the string of wampum was stained with red iron-oxide or even with blood and returned by a war runner. Among the Iroquois a string of black wampum was the official token by which brother and cousin tribes were notified of the death of a chief. Symbolic patterns ranging from squares, diamonds and parallel lines to hatchets, peace-pipes, animals, houses and human figures with meanings well-known to all Indians were woven into belts to commemorate events. The Penn treaty with the Indians of Pennsylvania is recorded on a belt which has two human figures with clasped hands. Wampum belts with symbolic patterns were used to convey messages from one tribe to another. Sometimes messages to several people were included in one belt. Strings with a definite proportion of white and dark beads were used to record names among such tribes as the Hurons and the Iroquois. These name strings were kept by the oldest matron in the clan. In the symbolic language of the Iroquois, the giving of a name was "the

casting of a necklace upon one's neck." A wampum collar was presented to a chief as a great compliment by the warriors of his tribe.

WANAMAKER, JOHN (1838-1922), American merchant and capitalist, born in Philadelphia, July 11, 1838. He was the son of a bricklayer and, as a boy, worked for a little time in his father's brickyard. Later he became an errand boy at \$1.25 a week, and then entered the clothing business at a somewhat better wage. In 1861, in partnership with a brother-in-law, Nathan Brown, he opened a small clothing store in Philadelphia, of which he became sole owner upon the death of Brown in 1868. The business expanded rapidly. In 1887, Wanamaker inaugurated for his employees a system of cooperation based on length of service, and, in his concern for the welfare of employees, was a pioneer in the field of industrial management. Following repeated enlargements of his Philadelphia store, he opened a store in New York, situated at Broadway between Eighth and Ninth Streets, in 1896. His capital for this new enterprise was \$7,500,000. His New York store, too, expanded rapidly, and soon became one of the largest and most important concerns of its kind in the world. In addition to his pioneering spirit in industrial relations, Wanamaker was also one of the pioneers of modern advertising and the acknowledged originator of the department store.

But his interests were not confined exclusively to business. They were, indeed, so wide that he may, with justice, be considered as a perfect type of the American merchant prince. Strongly Republican in politics, he was appointed postmaster-general in 1889 by President Harrison, and in this post proved himself extremely efficient and progressive. During the World War, his sympathies were strongly pro-ally from the outset of the conflict, and he was the chairman, in Philadelphia, of the National Security League. His philanthropies were numerous and important, the Y.M.C.A. and the Philadelphia Presbyterian Hospital being objects of his special concern. He died in Philadelphia on Dec. 12, 1922.

WANDERING JEW (*Zebrina pendula*), a decumbent or pendulous herb of the spiderwort family grown, especially by florists, as an ornamental. It is a native of Mexico widely cultivated in several foliage varieties. The much branched stems bear oblong leaves, striped with white and green above and purple below, and blue-purple flowers somewhat resembling those of the day lily. The name is applied also to a South American species of spiderwort (*Tradescantia fluminensis*) with prostrate stems and numerous white flowers, commonly found in greenhouses.

WANDERING JEW, THE. This legend, with slight variations, recounts that as Jesus is carrying his cross he pauses to rest on the door step of a Jewish cobbler who immediately hurries him off. Jesus turns to him saying, "Truly I go away, but tarry Thou till I come." Under this punishment the Jew wanders, unable to die. The legend is commonly believed to be medieval but can be traced definitely to a pamphlet

published in 1602. There are many legends of eternal wanderers in the Middle Ages, notably Cartaphilus and Joseph of Arimathea, and the legend of the Wandering Jew draws them into itself and replaces them rather than grows out of them.

WANDEROO (*Macaca silena*), a baboon-like monkey, called also lion-tailed monkey. This large macaque is a native of southeast India, and has become naturalized in China. It is distinguished by having a beard of enormous proportions encircling the whole face, and standing out gray or white against the deep black of the rest of the coat. The tail is long and tufted at the end. The wanderoo inhabits the deep jungles of Malabar, where it is found in flocks. *See also* MACAQUE.

WANG, C. T. (1882-), Chinese statesman, was born in Chekiang province. He studied in Japan, and in 1911 graduated from Yale University. He became secretary of the Chinese Y.M.C.A. in Shanghai, and was actively identified with the Republican revolutionary movement, being in the first cabinet, and vice-speaker of the first senate. In 1918-19 he went to the United States to secure recognition of the Canton Government, and was a delegate to the Paris Peace Conference, where he strongly opposed the signing by China of the Versailles Treaty. He headed the Chinese negotiations with Japan for the return of Shantung, in 1922 and in 1923-4 was director of Sino-Russian negotiations. He has been prominent in Kuomintang circles from the beginning, and became Minister for Foreign Affairs in the National Government in 1928. Previously he had been Minister for Foreign Affairs, and had acted as Premier at various times in the government at Peking. He played a large part in securing tariff autonomy for China at the beginning of 1929. Following a violent physical attack by radical agitators who resented his appeal to the League of Nations in connection with the Japanese occupation of Manchuria in the autumn of 1931, Wang resigned as Foreign Minister.

WANGANUI, a seaport of North Island, New Zealand, situated on the Wanganui River, about 70 mi. south of New Plymouth. The city lies at the foot of several low hills in a rich grazing district and is the center of important meat-packing houses. Frozen meats, dairy produce and wool are the chief exports. Pop. 1931, 25,050.

WANG CHUNG-HUI (1882-), Chinese jurist, was born in Kwangtung province. He studied in France, Germany, the United States and Great Britain, received a D.C.L. from Yale University in 1907, becoming a barrister-at-law of the Middle Temple, London. He was Minister for Foreign Affairs in the Provisional Republican Government in 1912, and the first Minister of Justice in the Republican Government at Peking. In 1922 and again in 1924 he served as Premier at Peking. From 1917-27 he was chairman of the Law Codification Commission and, in 1920, Chief Justice of the Supreme Court. In 1927 he became Minister of Justice in the Nationalist administration at Nanking, and served as the first head of the

judicial *yuan* after the establishment of the National Government in 1928-31. In 1929, he was elected an associate justice of the Permanent Court for International Justice. The drafting of the new legal codes of China and the reorganization of the judicial system were carried out under his direction. Wang Chung-hui was a member of the pre-republican revolutionary party, the *Tung Meng Hui*, and he has held a high place in Kuomintang councils.

WANHSIEN, a city of the province of Szechwan, China, the most important inland port, after Chungking, on the upper Yangtze River. It is a great distributing center for cotton yarn, cotton cloth and raw cotton. Opium is also extensively exported, and sugar and rape oil in small quantities. A wide coal field stretches to the rear of the city. Pop. 1929, 207,837.

WANNE-EICKEL, a German city in the Prussian province of Westphalia, situated on the Emscher and Rhine-Herne Canal. It borders on Gelsenkirchen, Bochum and Herne, and is in the neighborhood of coal mines. The city has two harbors and, next to Duisburg-Ruhrort, has the largest river port in Germany. Wanne, until 1897 called Bickern, united with Eickel and Rohlingshausen in 1926. Wanne-Eickel has medicinal baths and manufactures machines, ammonia and refrigerating apparatus. Pop. 1925, 91,024.

WAPAKONETA, a city in western Ohio, the county seat of Auglaize Co., situated on the Auglaize River, 13 mi. south of Lima. It is served by two railroads. Gas and oil are found in this region. Grain is the principal crop of the district. The city has many factories, making acetylene gas generators, churns, cigars, furniture and various other products. Wapakoneta was founded in 1833; incorporated as a town in 1849. Pop. 1920, 5,295; 1930, 5,378.

WAPITI, a North American DEER (*Cervus canadensis*), called also American elk. In the West this deer is commonly known as "elk," a misnomer, for



WAPITI OR AMERICAN ELK

the elk proper is the great European flat-horned deer corresponding to the North American moose. Wapiti, a Cree Indian name, is preferred as more distinctive. This large, stately deer was originally distributed over the whole continent from the Allegheny Mountains to the Pacific coast, and northward into Canada, but

now is almost extinct east of the Rockies, except on preserves. It is the largest of our deer except the moose, fine old stags measuring 9 to 12 ft. from tail to muzzle (the does are much smaller). The head supports magnificent, wide-spreading antlers, among the most perfect in the deer world. The coat is yellowish or brownish gray, with the neck and nape clothed in long chestnut-brown hair and the rump dull yellow.

These great deer separate in summer into family parties of a stag and a few does, and live quietly in forest glades and mountain pastures, where one or two fawns, beautifully striped and spotted with white, are born to each mother in May or June. They remain with the mother for about a year. In the autumn, when the stag's antlers are perfect, they form new partnerships after much calling, bugling, or "belling," as the musical challenge of the stag is called. The wapiti formerly gathered into locally migratory bands, sometimes numbering thousands, and spent the winter on chosen feeding-grounds. See ELK; Moose. E. I.

WAPPINGER, a confederacy of Algonkian tribes which occupied territory on the east bank of the Hudson River extending from Poughkeepsie to Manhattan Island and eastward to beyond the Connecticut River. Their confederacy was composed of nine tribes, some of which were also subdivided. The eastern bands gradually and peacefully sold their lands to the whites but the western bands became involved in a war with the Dutch in 1640 in which they lost more than 1,000 warriors. In 1756 the few remaining members joined the Nanticoke at Chenango, near the present site of Binghamton, N.Y., and placed themselves under the protection of the Iroquois. They were finally merged with the Delaware.

WAR, DECLARATION OF, an act of municipal law which announces the beginning of hostilities between states. The declaration not only implies the beginning of hostile relations and military operations, but also the beginning of the state of war—a legal condition of things from which legal consequences flow. A declaration of war is not necessary to its beginning, but international agreements have sought to provide such declarations. The formal right to declare war in the United States is vested in CONGRESS. The legislative body, however, is hardly in a position to judge of a situation which might justly occasion war. The recommendation of the President is the first step, Congress must declare a state of war to exist, and finally the President must give his approval to the resolution. The Mexican War is often regarded as made by President JAMES K. POLK. The declaration of war against Spain was really a resolution for INTERVENTION in Cuba. C. E. M.

WAR, DEPARTMENT OF, a governmental department in charge of the military establishment and land defense of the United States, as well as of some civil matters assigned it by acts of Congress. The Secretary of War assumes direction of all appropriations for the support of the army, of munition pro-

duction at government arsenals and factories, preparation of national defenses and seacoast fortifications, the Military Academy, river and harbor improvements, leases and other privileges on lands under the control of the War Department, and certain transportation and terminal facilities on inland and coastwise waterways. Bridges built by Congressional authorization over navigable waters must have their plans and locations approved by the War Department. Among the matters under direct charge of the Assistant Secretary of War are those relating to national military parks, national monuments and national cemeteries. Another Assistant Secretary fosters military aeronautics. The War Department General Staff, formed in 1920, is composed of men charged with maintaining military preparedness, through military training and the formulation of war plans. There are in addition a number of military bureaus headed by officers of the regular army. The Judge Advocate General is the official legal adviser of the Department. The Bureau of Insular Affairs is under the immediate direction of the Secretary of War and controls all matters of civil government in the Philippine Islands and the Canal Zone. S. C. W.

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WAR, OUTLAWRY OF. See under PEACE.

WAR AND PEACE, a historical novel by LIOV TOLSTOY; published 1865-68. This great panoramic work, with the Napoleonic Wars for its central theme, is divided into four parts: *Before Tilsit (1805-07)*; *The Invasion (1807-12)*; *The French at Moscow (1812)*; *Epilogue (1812-20)*. In this monumental work scenes of peace alternate with vivid scenes on the field of battle, and every class of society, both Russian and French, is represented, from the noblest prince to the lowliest peasant. Of the dozens of characters introduced some 35 are actually historical, including Czar Nicholas I, Napoleon and General Kutuzov. The hero is Pierre Bezukhov, heir to the greatest fortune in Russia, a young man who at last finds among simple peasants a true understanding of life, securing happiness, after the death of his frivolous first wife, Elena, in the love of Natalie Rostov, the heroine. Prince Andrei Bolkonski, the valiant soldier and Natalie's first love, is an important secondary character.

WARBLE FLIES, the popular name for various species of flies of the family *Destridae*. The two principal species in America are *Hypoderma bovis* and *H. lineatum*. Eggs are attached to hairs, usually on the hind legs of cattle, but sometimes on the flanks. They soon hatch and the larvæ burrow through the skin. They feed for several months on or in the tissues of the abdomen and thorax of the host animal. In early winter they migrate to the back and lodge just under the skin. They cut exit holes through the skin, but do not immediately leave the body of the animal. When ready to pupate, they work their way out through the exit hole and fall to the ground. Adult flies emerge in spring. The holes produced by the larvæ result in "grubby hides" which are almost

worthless. The damage they do to American cattle has been estimated at \$50,000,000 annually. Animals may be protected by smearing their legs with strong smelling oils. This may be quickly done by driving them through a vat filled hip high with the liquid. Nicotine powders may be dusted on the backs of infested animals.

M. G. K.

WARBLER, the name given to a numerous family (*Sylviidae*) of passerine birds, comprising about 500 species found chiefly in the Old World. In America they are generally called Old World warblers, to avoid confusion with the large New World family of wood warblers (*Compsothlypidae*).

The warblers are of small size and mostly plain plumage, with rather slender bills and short broad wings containing ten primaries. For the most part, they are highly migratory, some, as the barred warbler (*Sylvia nisoria*) breeding in Sweden and wintering in central Africa. Warblers feed very largely upon insects, but also eat small mollusks and various fruits. They are found in a wide range of situations, living in fields, groves, grassy plains, bushy places and reedy swamps. Their notes are exceedingly varied, some possessing a remarkably sweet song, while others have only a cricket-like chirp.

Among the more important groups are the reed warblers (*Acrocephalus*), the grasshopper warblers (*Locustella*), the fan-tailed warblers (*Cisticola*), the bush warblers (*Tribuna*), the wren warblers (*Prinia*) and the remarkable tailor-birds (*Sutoria*). Here belong the whitethroat (*Sylvia sylvia*), a favorite summer visitor in Great Britain, and also the blackcap (*S. atricapilla*) and the garden warbler (*S. hortensis*). In America the warblers are represented by some 20 species of gnatcatcher (*Poliophtila*) and two species of kinglets. See also BLACKCAP; KINGLET; WOOD WARBLER.

A. B. J.

WAR-BONNET, a ceremonial feather headdress of the Plains Indians rigidly worn only by distinguished warriors of the tribe. Formerly each feather in a bonnet represented an exploit of its wearer and his associates on the field of battle, thus making it emblematic of the prowess of a warrior. Now a war-bonnet is merely a conventional mode of dress. These feathers, usually eagle tail, are carefully selected for form and beauty. They are sewn in an upright position just above an ornamented band which reaches across the forehead from one ear to the other. If the bonnet has a tail piece it is similarly decorated with feathers and extends from the back of the head to the ground. The ear ornaments are either conventional disks or shells or some article of similar shape about which the warrior has dreamed. Ermine skins and hair are sometimes attached to these ornaments.

Another type of war-bonnet is called the horn bonnet. This consists of a tightly fitting fur cap with a buffalo horn on each side above the ear.

WAR CHESS, a popular name for WAR GAME.

WAR COLLEGE, U.S. ARMY, a college at Washington, D.C., to train officers for high command and for general staff duty with units larger than the

army corps, for War Department General Staff duty and duty in the office of the Assistant Secretary of War and for corps area command and general staff duty. It supplements similar instruction given at the Command and General Staff School at Fort Leavenworth, Kans. The college conducts but one course of instruction. Students are selected from officers of the regular army who are graduates of the Command and General Staff School or have had training accepted as equivalent thereto. Officers of the National Guard and organized reserves must be graduates of the regular or special short course of the Command and General Staff School or of the Command and General Staff Correspondence School. In addition, especially selected officers of the Navy and Marine Corps and of the National Guard and organized reserves are sent to the Army War College. The length of the course is ten months. Officers of the regular army, navy and marine corps take the full course. Certain parts or the whole of the course may be taken by officers of the National Guard and organized reserves. The Army War College was founded in 1903 by Elihu Root, Secretary of War. S. C. V.

WAR COLLEGE, U.S. NAVY, a college located at Newport, R.I., founded in 1885, ten years before similar schools were founded in England, France, Germany and Italy. Rear Admiral Stephen B. Luce was the first president, and through his efforts gave the college life and established its mission. Rear Admiral A. T. Mahan, whose works on *Sea Power* brought it fame, was the second president. Captain W. McCarty Little was its mainstay in its most trying days.

Its early career was rough sledding as it had few believers in it, not only among naval officers, but among the general public. The cruise of a fleet of U.S. battleships around the world in 1907-1909, brought the War College into prominence. The need for postgraduate work was demonstrated clearly.

The mission of the War College is the instruction of student officers in the conduct of war from the naval point of view, in order that they may be better fitted for command and for duty on command staffs. The internal organization of the college is divided into two main departments for instruction and training purposes; the departments of operation and intelligence. The officers attached to these departments are required to be graduates of the college.

The subjects covered in the senior and junior classes are the solution of operations problems, involving command strategy, tactics and logistics; historical studies and the presentation of committee reports before the assembled classes; the study and solution of international law situations with discussion of decisions; lectures; thesis writing; critique and discussions. Four correspondence courses are in operation, including strategy and tactics, special course in strategy and tactics for officers not of the regular Army and Navy commissioned services, international law, and advanced international law.

Some 400 students take these courses. The course

at the college, both senior and junior classes, is one year. The college has a staff numbering 22 officers and there are 77 officers of various grades and corps under instruction, and some 360 take the four correspondence courses, the graduations being about 75 annually. The institution has proved its worth.

The college is directly under the Chief of Naval Operations, who as the technical head of the Navy, is responsible for its general policies. The President of the college is ex-officio a member of the General Board of the Navy.

R. E. C.

WARD, AARON MONTGOMERY (1843-1913), American mail order merchant, was born in Chatham, N.J., in 1843. He received a public school education at Niles, Mich., and began his business career in St. Joseph, Mich., as clerk in a general store of which he became manager in three years. When 23 he was employed by Marshall, Field & Company (then Field, Palmer & Leiter), but left after two years to travel for a St. Louis mercantile firm. In 1872 he established the mail order business of Montgomery Ward Company, employing his brother-in-law and one clerk to help him. By his peculiar and remarkable talents for merchandising, Ward increased his business to one employing 6,000 people and handling yearly \$70,000,000 of sales to all parts of the world. Outside of business his outstanding achievement was the preservation of Grant Park for the city of Chicago. He died in Chicago Dec. 7, 1913.

WARD, ARTEMUS, pen name of the American humorist, CHARLES FARRAR BROWNE.

WARD, MRS. HUMPHRY. See **WARD, MARY AUGUSTA.**

WARD, JOHN QUINCY ADAMS (1830-1910), American sculptor, was born in Urbana, O., June 29, 1830. He first studied for the bar, but in 1850 began to study sculpture under HENRY K. BROWN in New York. He remained with Brown until 1857, assisting him in many of his works. His first work as an independent sculptor was done in Washington the following year, when he modeled busts of a number of prominent men including Alexander Stephens, Joshua R. Giddings and Hannibal Hamlin. He also made his first sketch for *The Indian Hunter* at this time. He settled in New York in 1861. In 1863 he was elected to the National Academy and was its president one year. Ward's works include *The Indian Hunter*, *A Private of the Seventh Regiment*, *Pilgrim*, and *Shakespeare*, all in Central Park, New York; the statue of Washington on the steps of the subtreasury building, New York; a statue of Henry Ward Beecher, in Brooklyn; "The Good Samaritan"; "The Freedman"; statues of Commodore Perry and General Thomas; and equestrian statues of Sheridan and Hancock. He died in New York, May 1, 1910.

WARD, MARY AUGUSTA (1851-1920), British author writing under the name of Mrs. Humphry Ward, was born at Hobart, Tasmania, June 11, 1851, the daughter of Thomas Arnold, son of Dr. Arnold of Rugby. She was educated in England and in 1872 married Humphry Ward, of the Oxford fac-

ulty. Her first work to attract attention was *Robert Elsmere*, 1888, which sold enormously, was translated into several languages and almost at once brought the author world-wide fame. Many other novels followed of which a few were *David Grieve*, *Lady Rose's Daughter*, *The Marriage of William Ashe* and *Fenwick's Career*. She died in London, Mar. 24, 1920.

WARD, NATHANIEL (1578 or 1580-1652), American clergyman, was born in Haverhill, England, between 1578-80. He graduated from Cambridge, in 1607, studied law and theology, and became a minister. He lectured in London, and came to Massachusetts in 1634, where he became minister of the church in Ipswich. He drafted the *Body of Liberties*, adopted in 1641 as a code of laws for the colony. Several editions were printed of his satirical book, *The Simple Cobbler*, which first appeared in 1647 and was re-edited in 1718 and 1843. When Ward returned to England in 1646, he was made minister of the church of Shenfield. He died in Shenfield in 1652.

WAR DEBTS, a term used to designate solely the debts contracted among themselves by the various Allied nations participating in the World War—the loans made by the German government to its allies having been cancelled by the treaties of peace. The greatest lenders in the war were the United States, Great Britain and France, while the debtors numbered over sixteen. The total amount of advances made by the United States Treasury to the various governments under the Liberty Bond Acts aggregated \$9,589,236,575. In addition, foreign governments obtained on credit from the United States after the war, advances which represented the surplus of war supplies, relief credits, purchases of flour on credit from the United States Grain Corporation and credits extended by the United States Shipping Board. In Feb. 1922 the World War Foreign Debt Commission was created by an Act of Congress and an official request was sent out by the U.S. Government to the various debtor countries to fund their obligations. The aggregate total amount of advances made by the U.S. Government less interest amounted to \$10,350,000,000. Interest was added at the rate of 4.25% up to Dec. 15, 1922 and 3% from then until the dates of the various settlements. The original principal plus the accrued interest became, with minor adjustments, the principal of the funded debt. The rate of interest charged by the U.S. Government from the date of settlement was not uniform. It amounted on an average to 3.3% for Great Britain, 1.8% for Belgium, and only .4% for Italy. If one takes into consideration the decreased rate of interest, this amounts to a cancellation of about 51% of the total debt. The total amount of loans made by the United States and the amount repaid up to Jan. 31, 1931 may be seen from the table below.

Of the countries named here Armenia is no longer in existence and only Russia has made no settlement of any kind.

FOREIGN DEBTS TO THE UNITED STATES

(Figures as of January 31, 1931)

	Original Obligation (Principal)	Original Principal of Bonds Under Funding Agreement	Total Debt Out- standing 1/31/31	Payments to Date (Principal and Interest)
(In million dollars)				
Armenia	11.9	...	18.4	...
Austria	24.0	24.6	23.7	.9
Belgium	397.0	417.7	404.7	46.5
Cuba	10.0	12.3
Czechoslovakia ..	91.8	185.0	168.5	16.8
Estonia	13.9	13.8	16.4	1.0
Finland	8.2	9.0	8.6	2.8
France	3,404.8	4,025.0	3,865.0	465.4
Great Britain ...	4,277.0	4,600.0	4,398.0	1,845.8
Greece	27.1	32.4	31.7	2.7
Hungary	1.6	1.9	1.9	.5
Italy	1,648.0	2,042.0	2,017.0	84.2
Latvia	5.1	5.7	6.8	.5
Lithuania	4.9	6.4	6.2	1.0
Poland	159.6	178.7	206.0	19.6
Rumania	37.9	66.5	64.5	4.1
Russia	192.6	...	308.6	8.8
Yugoslavia	51.7	62.8	61.8	2.4
Total	10,350.4	11,672.1	11,608.7	2,515.3 *

* Includes \$205,000 paid by Liberia and Nicaragua.

Of the other great creditors Great Britain advanced to France \$2,845,000,000; to Italy, \$2,713,000,000; and to Russia \$3,358,000,000.

The total advances made by the British government during the war and shortly thereafter aggregated about \$10,000,000,000. The British attitude toward war debts is embodied in the so-called Balfour principle, which is to the effect that the British government will seek to collect from its debtors only such amounts as would in their aggregate equal the sums paid by Great Britain to the United States. The advances of France during the war and shortly after the armistice reached a total of \$2,536,000,000 of which Russia obtained \$1,257,000,000. As in the case of the United States, Russia has made no settlement either with Great Britain or with France.

M. N.

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WAR DEMOCRATS, in the northern states during the Civil War, persons normally of other political affiliations than Democratic, who supported the Democratic party as a protest against the prosecution of the war.

WARE, WILLIAM ROBERT (1832-1915), American architect, was born at Cambridge, Mass., May 27, 1832. He was graduated from Harvard in 1852, receiving his B.S. degree four years later. From 1860-81 he practiced architecture in Boston, and was professor of architecture at the Massachusetts Institute of Technology. He left in 1881 to accept the chair at Columbia. Among the buildings that Ware designed are Harvard Memorial Hall, and the American School of Classical Studies at Athens, Greece. His books in-

clude *Modern Perspective*, *The American Vignola* and *Architectural Shades and Shadows*. Ware died at Milton, Mass., June 9, 1915.

WARE, a town and village in Hampshire Co., western Massachusetts. The village is situated on the Ware River, 25 mi. northeast of Springfield. Bus lines and two railroads afford transportation. Ware has cotton, woolen, underwear and various other factories. The District of Ware was formed in 1761 from sections of Brookfield, Palmer and Western. In 1775 this became an incorporated town. Pop. 1920, 8,525; 1930, 7,385.

WAREHAM, a town of Plymouth Co., eastern Massachusetts, situated on Buzzards Bay, about 49 mi. southeast of Boston. The New Haven Railroad and buses afford transportation. Wareham is a popular summer resort. There are extensive shell-fish fisheries here. Other local industries include fishing and the manufacture of cranberry sauce, nails and horseshoes. Wareham was organized as a town in 1739. Pop. 1920, 4,415; 1930, 5,686.

WAREHOUSE RECEIPT, a paper acknowledging that the signer has in his possession specified property of another for storage, which he must deliver to a named person or to his order. This warehouse receipt is negotiable under the Uniform Warehouse Receipts Act of 1912.

WAREHOUSING, the storing of certain commodities such as wheat, wool, corn and fruit at one or more stages of marketing. An owner of goods in a warehouse often uses them to secure credit. A warehouse receipt is issued by the storage company stating not only the amount, but also the grade of goods so that banks issuing credit may estimate the value of the collateral against which they are asked to advance money. Warehouses have been standardized by the United States Warehouse Act of 1916 under which licenses are granted to storage companies accepting certain regulations provided for in the act.

WAR FINANCE. It is almost impossible to state with any degree of accuracy the total cost of the World War. This is reflected in the great discrepancy to be found in the published figures which vary with the methods of calculation adopted; so that, for example, the cost of the war to Great Britain has been variously estimated at between 11,076,000,000 and 3,500,000,000 pounds sterling. The second figure, calculated by Edgar Crammond before the London Institute of Bankers in June 1930, took into consideration only the net cost of the war and included all the gains to Great Britain, while the former figure represents gross, including indirect costs.

There have been estimates based on the difference in expenditures of the various belligerents before and those during the war, the increased expenditures during the war being construed as the cost of the war. That this method is not entirely accurate may be seen from the fact that, while expenditures did increase, the taxation of certain classes of the public, notably those who profited greatly from the war, also increased.

Most statisticians agree that the best way to calculate the cost of the war is to divide it into direct and indirect costs. Direct costs include all the expenditures of the belligerents for actually carrying on the war, such as maintenance of armies, ammunition and the like. Indirect costs embrace all the economic losses caused indirectly by the war, such as the loss of life and the value of property destroyed or damaged.

According to E. L. Bogart, the direct cost of the war is placed at \$186,233,637,000 while the indirect cost of the war is placed at \$151,646,943,000. The total cost of the war may be estimated, therefore, at approximately \$338,000,000,000. The direct cost of the war to the individual belligerents is shown in the table below.

DIRECT COSTS OF THE WAR

Allied and Associated Powers:	
United States	\$22,625,252,843
Great Britain	35,334,011,868
British Colonies:	
Canada	1,665,576,032
Australia	1,423,208,040
New Zealand	378,750,000
India	601,279,000
Union of South Africa	300,000,000
Other colonies	125,000,000
France	24,265,582,800
Russia	22,593,950,000
Italy	12,413,998,000
Belgium	1,210,125,090
Rumania	1,600,000,000
Japan	40,000,000
Serbia	399,400,000
Greece	270,000,000
Other Entente Allies	500,000,000
	<hr/>
	\$125,746,133,673
Central Powers:	
Germany	\$37,775,000,000
Austria-Hungary	20,622,960,600
Turkey	1,430,000,000
Bulgaria	815,200,000
	<hr/>
Grand Total	\$60,643,160,600

In addition to the belligerent nations, the various neutral countries spent about \$1,750,000,000 directly or indirectly for war purposes. These expenditures were caused by the necessity of maintaining their neutrality and by the increased armies kept by the various neutral countries during the war. The war expenditures of the neutral countries are included as part of the indirect cost of the war. The table below shows the indirect cost of the war classified by individual items.

INDIRECT COSTS OF THE WAR

Economic value of human lives lost:	
Soldiers	\$33,568,471,280
Civilians	33,568,471,280
Value of property lost:	
On land	29,960,000,000
On sea	6,800,000,000
Loss in production	45,000,000,000
War relief	1,000,000,000
Loss to neutrals	1,750,000,000
	<hr/>
Total	\$151,646,942,560

It should be noted, however, that while the direct cost of the war can be calculated with a certain degree of accuracy, the indirect cost can only be roughly estimated, for the difficulty of estimating the money value of a human life is obvious. M. N.

BIBLIOGRAPHY.—E. L. Bogart, *Direct and Indirect Costs of the World War*.

WAR FINANCE CORPORATION, an extraordinary body created by the Treasury Department of the United States, authorized by Act of Congress, Apr. 5, 1918, to assist in the prosecution of the World War. Its purpose was to secure funds for necessary industrial enterprises unable to secure credit from private sources at reasonable rates. The corporation possessed a capital stock of \$500,000,000, owned by the Government, had power to sell bonds to raise additional capital, and had authority to lend these funds to banks to cover loans made by the latter for the benefit of war industries. Its board of directors was four men appointed by the national Executive and the Secretary of the Treasury. Up to Oct. 31, 1918, the corporation had advanced the sum of \$67,716,342.49. For one year after the end of the war the corporation served to make loans to foreign governments and their citizens with which to settle trade balances with the United States.

WAR GAME, an exercise for the purpose of military instruction and for the test of strategic and tactical plans, in which officers carry out on a map the operations of imaginary troops or war ships.

War Game, U.S. Army. The troops or ships are represented by pins, beads, strips of paper, blocks of wood or other devices. Orders and messages are written as if the action were real. All exercises are conducted by an umpire. Officers command opposing bodies of troops, in accordance with a prearranged situation, as in the maneuver. The war game gives practice in map reading and in computing the elements of time and space; it familiarizes officers with military geography, and teaches them to form decisions promptly, issue orders and write messages and reports. It draws upon all sources of military knowledge, promotes theoretical study and gives zest to the study of the driest details of the military art. The war gaming of war plans brings out principles and difficulties that are ignored by the unaided imagination. Maps on a scale of 12 in. to the mile are good for movements of small units; 6 in. to the mile for divisions, and 1 in. to the mile for armies. The war game was invented by the Prussian war counselor von Reisswitz, who in 1811 devised a game conducted on a sand terrain. His son, Lieut. von Reisswitz, adapted the war game to the map and published rules in 1824. General von Verdy du Vernois in 1876 simplified the game by substituting the judgment of an umpire for a system of complicated rules. The expression war game is often applied to maneuvers with troops or ships. This is an incorrect and misleading use of the term. S. C. V.

War Game, U.S. Navy. The game board maneuvers stimulate the uses of all types and classes of

ships now in use in naval warfare. The handling of aircraft, the use of diminutive ships, weather conditions, state of the sea, casualties as to ships and men, all except running of the ships under their own power and firing of guns, come into play while skilled umpires and referees act. A commander-in-chief for each side is selected and players detailed. The players are then indoctrinated with the purpose of the leader's plan and the method he proposes to use in its execution. There is thus the problem and the maneuver. The conditions of the situation require action. The study of the situation gives the mission and decision. Preparation of the necessary orders and instruction of subordinates follow; new situations develop and the maneuver is continued until a no further value point is reached and the game is called by the umpires.

The object of application in research work and at the maneuver board, is self-training. Tactical problems are framed to cover the tactical phases of naval warfare. The same form of problem calls for the framing of strategic problems, under motives of problems; general situation; special situation; requirements, and assumptions.

Both tactical and strategic (*see* STRATEGY, *Naval*) problems are solved by means of an estimate of the situation which leads to a reasoned out decision and the issuance of orders. The direct motive of the tactical maneuver is to deduce, develop and illustrate tactical principles, and to afford opportunity for the practical application of such principles. R. E. C.

BIBLIOGRAPHY.—Gen. I. von Verdy du Vernois, *Simplified War Game*; Maj. W. R. Livermore, *The American Kriegsspiel*; Maj. Farrand Sayre, *Map Maneuvers and Tactical Rides*.

WAR HAWKS, a group of comparatively young men elected to the Congress of the United States in 1810, representing the triumph of an insurgent movement against the diplomatic policies of Jefferson and Madison. These newly elected congressmen evidenced the frontier sentiment that the United States acquire Canada and Florida and reflected the belligerent patriotism of certain regions in the South and Middle States; their influence committed President Madison to recommendations of war against Great Britain. (*See* WAR OF 1812.) Henry Clay and Richard M. Johnston of Kentucky, Peter B. Porter of New York, Felix Grundy of Tennessee, John C. Calhoun, Langdon Cheves and William Lowndes of South Carolina entered national politics as War Hawks.

WAR INDUSTRIES BOARD, an extraordinary body created by order of Pres. Wilson, July 28, 1917, to assist in the prosecution of the WORLD WAR. Its functions were to coordinate activities of industry and transportation; to maintain a steady flow of necessities to the Allied and U.S. troops abroad; to obtain raw materials to manufacturers so that essential industries would be supplied; and to stimulate production of indispensable goods, such as steel, potash, chemicals, dyes, and nitrates. Various committees, manned in large part by "dollar a year men," whose expenses were defrayed by them or by their previous employers, fixed the priority of need of mate-

rials, fixed fair prices, attended to the enlargement of factories, the recruiting and housing of labor, and like activities, with the result that the industrial capacity of the nation is estimated to have increased 20% at the close of the war.

WAR LABOR BOARD, UNITED STATES, the product of the exigencies of the World War, having as its prime object the settlement by mediation and conciliation of all controversies arising between employers and workers in fields of production necessary for the effective conduct of the war, and in such other fields of national activity as might in the opinion of the Board detrimentally affect such production. To accomplish its objective the Board was empowered to "provide, by appointment or otherwise, for committees or boards to sit in various parts of the country where controversies arise and secure settlement by local mediation and conciliation; and to summon the parties to controversies for hearing and action by the National Board in event of failure to secure settlement by mediation and conciliation." S. C. W.

BIBLIOGRAPHY.—U. S. Service Monograph, No. 28.

WAR LEGISLATION. "The powers of Congress to provide for national defence are practically unlimited." A mere list of the war measures passed by Congress in 1917-18 is perhaps sufficient outstanding data for the assertion. Chief among these measures were the selective draft laws, the insurance act, the liberty loan laws, the steeply graduated income, inheritance and excess profits taxes, the national food and fuel control law, the railway and means of communication act, and the espionage and sedition acts. Supplementary to these were the measures setting up emergency administrative units, among which were the war industries board, the priorities board, the United States Railway Administration, the emergency fleet corporation, the food administration, the fuel administration, the aircraft board, the war labor board, the war labor policies board, the United States employment service, the bureau of housing, the war trade board, the board for vocational education, the bureau of war risk insurance, the council of national defense, the censorship board, the committee on public information, the alien property custodian, the war finance corporation and the capital issues committee.

S. C. W.

BIBLIOGRAPHY.—H. A. Van Dorn, *Government Owned Corporations*, 1926; C. A. Beard, *American Government and Politics*, 1928.

WARMING, JOHANNES EUGERIUS BÜLOW (1841-1924), Danish botanist, was born on the island of Mano, Nov. 3, 1841. In 1882 he became professor of botany at Stockholm, Sweden, and professor of botany at Copenhagen and director of the botanical gardens in 1885. Warming traveled widely upon botanical expeditions, and made particular studies of the flora of Greenland, Norway, Brazil, Venezuela and the West Indies. He was noted for his great work in plant ecology, and established it as one of the important divisions of botany. His chief botanical writings were *Handbook of Systematic Botany*, 1879,

Ecology of Plants, 1895, and *Textbook of Ecological Plant Geography*, 1918. He died at Copenhagen, Apr. 2, 1924.

WARM SPRINGS, a group name for the several tribes, including the Wasco, Paiute and Tenino, confined to the Warm Springs Reservation in Oregon in 1855. The population in 1931 was about 800.

WARNER, CHARLES DUDLEY (1829-1900), American author, editor and man of letters, was born at Plainfield, Mass., Sept. 12, 1829. He was educated at Hamilton College and the Law School of the University of Pennsylvania. He edited the *American Men of Letters* series and *A Library of the World's Best Literature*, collaborated with Mark Twain (see CLEMENS, S. L.) in *The Gilded Age*, and wrote biographies, essays, novels and travel books. Warner is perhaps best known as a humorist and essayist. Among his books are *Backlog Studies*, *Being a Boy* and *My Summer in a Garden*.

WARNER, GLEN SCOBEE (1871-), football coach, was born at Springville, N.Y., Apr. 5, 1871. He graduated from Cornell University, 1894, where he was football coach in 1897-98 and 1904-06. During 1915-23 Warner was in charge of the University of Pittsburgh football team, and in 1924 became coach at Stanford University. He is chiefly known for his "double wing-back" formation, in which four players are stationed on one side of the center, with left and right half-backs placed outside and behind either end, enveloping the opposing flanks. The massed Warner formation is used to disguise a variety of reverses, fake and double reverses, and straight "power bucks" executed by the backs.

WARNSDORF. See VARNSDORF.

WAR OF 1812, June 18, 1812 - Feb. 17, 1815, between the United States and Great Britain. With the resumption of war between France and England in 1803, American maritime commerce suffered by the pretensions of each belligerent to maintain a blockade of the other's coasts. English aggression was made more annoying by the use of IMPRESSMENT AND SEARCH. By means of embargo acts and NONINTERCOURSE ACTS President Jefferson attempted to discipline the belligerents by denying them American products from any possible source. He succeeded only in creating economic distress and political disaffection in New England. In the elections of 1810 several WAR-HAWKS, representing the vigorous nationalism of the West, and desiring war with England as a means of the conquest of Canada and the consequent extension of the American fur-trading and agricultural frontiers, and of removing the Indian menace to the frontier settlements, came into Congress; when Congress met in Nov. 1811, this element seized control. The impertinence of the British minister at Washington, James Jackson, and the revelation of the HENRY LETTERS strengthened feeling against Great Britain. On June 1, 1812 President Madison transmitted to the Senate confidential recommendations for a declaration of war, citing the impressment of American seamen, depredations by British vessels upon American ship-

ping along the Atlantic coast, and the capture of American cargoes in violation of international law. Against the opposition of New England congressmen, who had no interest in the conquest of Canada and were consequently less disposed to "vindicate the national honor," war was declared.

The original campaign plans called for an attack upon Canada from two points, Detroit and the Niagara River. The incompetence of Gen. Hull, entrusted with the western campaign, was responsible for the SURRENDER OF DETROIT in Aug. 1812; in the same month the garrison evacuating Ft. Dearborn (see FORT DEARBORN MASSACRE) at Hull's orders was massacred by Indians. Most Indian tribes allied themselves with the British. To retake Detroit and meet the Indian menace Gen. Harrison was assigned command of the army in the West. On the Niagara line the Army of the Centre, at the BATTLE OF QUEENSTON HEIGHTS, Oct. 1812, was badly defeated. Meanwhile the brilliant sequence of American naval victories was begun (see ESSEX AND ALERT; CONSTITUTION AND GUERRIERE; WASP AND FROLIC; UNITED STATES AND MACEDONIAN).

In 1813 Gen. Harrison won three engagements, at Raisin River (see RAISIN RIVER, BATTLE OF), Ft. Meigs (see FORT MEIGS, BATTLE OF) and the Thames, (see THAMES, BATTLE OF), and with the assistance of Capt. Perry's naval victory (see LAKE ERIE, BATTLE OF) restored the West to American control. Plans for the Army of the Center and the Army of the North, the latter in upstate New York, called for a dual invasion of Canada and a uniting of the two armies before Montreal. The Army of the North, having lain inactive under the incompetent Gen. Dearborn, under Generals Wilkinson and Hampton engaged in a short, fruitless campaign, returning prematurely to winter quarters. On the Niagara frontier the Americans were defeated at Oswego (see OSWEGO, BATTLE OF); there as in the Lake Champlain region the campaign was marked by sluggishness and bad management. In the naval engagements of the ships of war, HORNET AND PEACOCK and ENTERPRISE AND BOXER, the American vessels were successful, but the British won the contests between the ships CHESAPEAKE AND SHANNON and ARGUS AND PELICAN. American privateers, however, suffered more serious losses than they wrought. The American merchant marine entered a speedy decline.

In 1814, under the newly promoted Generals Izard and Brown in the northern departments, the army was successful in repelling the British counter-invasion in the St. Lawrence region (see PLATTSBURG, BATTLE OF; LAKE CHAMPLAIN, BATTLE OF) and in checking the invasion at Niagara (see LUNDY'S LANE, BATTLE OF; CHIPPEWA, BATTLE OF; FORT ERIE, BATTLE OF). The British took control of Chesapeake Bay, however, landed an army on the Maryland peninsula, and against absurdly feeble opposition won the BATTLE OF BLADENSBURG, captured and wantonly razed the city of Washington. Attempting to take Baltimore, however, they were repulsed at Ft. McHenry (see

FORT McHENRY, BATTLE OF). At sea the American vessel *Essex* was vanquished in an uneven battle with the British ships *Phoebe* and *Cherub* near Valparaíso, Chile; the American vessel *Wasp* won brilliant engagements.

The HARTFORD CONVENTION late in 1814 was evidence of the intense opposition of New England to the war. War loans had drained the Middle States of currency; after Aug. 1814, a financial crash caused widespread privation. The failure of the several attempts to seize Canada disheartened the chief proponents of the war. Great Britain was equally amenable to peace; and the TREATY OF GHENT, which practically established a *status quo ante bellum*, was concluded on Dec. 24, 1814. In Louisiana, however, where news of the peace had not yet reached, on Jan. 8, 1815, an invading British army was defeated and forced to withdraw by Gen. Jackson (see NEW ORLEANS, BATTLE OF); and at sea two belated conflicts, between the ships *Constitution* and *Cyane*, *Levant*, and the ships *Hornet* and *Penguin*, were American successes. E. D. B.

BIBLIOGRAPHY.—See especially Henry Adams, *History of the United States of America during the Administrations of Jefferson and Adams*, 9 vols., 1921; J. W. Pratt, *Expansionists of 1812*, 1925, and J. F. Zimmermann, *Impressment of American Seamen*, 1925, treat of causes. See C. P. Lucas, *Canadian War of 1812*, 1906; F. A. Updyke, *Diplomacy of the War of 1812*, 1915; A. T. Mahan, *Sea Power in its Relation to the War of 1812*, 1919. Source documents are assembled in *Historical Register of the United States*, T. H. Palmer, ed., 4 vols., 1814-16; *Official Letters of the Military and Naval Officers of the United States*, John Brannen, ed., 1823; *Canadian War of 1812*, W. C. H. Wood, ed., 3 vols., 1928.

WAR OF SECESSION. See CIVIL WAR.

WAR OF THE PACIFIC. See CHILE.

WAR PENSIONS. See REPARATIONS; PENSIONS, GOVERNMENTAL.

WARPING, a textile manufacturing process or series of processes by which yarns from spools, cones, or other small packages are wound side by side on large spools, known as "beams," preparatory to being used in WEAVING as warp threads, which run lengthwise of the cloth. Usually in the case of silk and often in that of wool, the yarns are first wound in narrow sections side by side on a large reel from a relatively small number of the smaller packages, and are then unwound from the reel on to the loom beams. The method most commonly employed for cotton (see COTTON MANUFACTURE) and extensively used for other yarns consists of winding portions of the warp on separate beams, called "section beams," and combining these on the slasher or sizing machine. Warps which are to be dyed (see DYEING), mercerized (see MERCERIZING), or otherwise treated, are often first wound in the form of long ropes or "chains," rather than on beams, and are wound on beams after treatment. Many "ball warps" thus treated are wound on quills, rather than beams, and are used for filling threads, which run crosswise of the fabric. High-speed warping, rapidly becoming popular, draws the yarn either from stationary cones over the ends or

from revolving ball-bearing cheeses, which may be stopped quickly by brakes. E. D. F.

WARRANT. A writ issued by a magistrate or by a judge of a superior court addressed to a peace officer requiring him to arrest a person named and bring him before the magistrate or court to be examined with reference to, or answer to, some offense with which he is charged. The issuance of warrants is generally governed by constitution or statutory provisions. In general, a warrant will issue only after complaint under oath charging the commission of a crime and reason to believe that the person accused committed it. The term is used also for the authority given to a collector of taxes whereby he may distrain and sell property on default of taxes.

WARRANT OFFICERS, NAVY AND MARINE. Boatswains, gunners, electricians, radio electricians, machinists, carpenters, pay clerks, acting pay clerks, sailmakers, pharmacists, marine gunners and quartermaster clerks are warrant officers. They take precedence over each other on the ACTIVE LIST of the Navy or Marine Corps according to the date of their warrants; and in case the warrants of two or more of them are of the same date, then according to the order in which their names are borne upon the official Navy Register, as kept in the Navy Department. They take precedence next after midshipmen and ahead of all mates.

After six years from the date of warrant, boatswains, gunners, electricians, radio electricians, machinists, carpenters, sailmakers, pharmacists, and pay clerks (upon completion of a total service of six years as pay clerk, acting pay clerk and paymaster's clerk) if duly qualified, shall be commissioned chief boatswains, chief gunners, chief electricians, chief radio electricians, chief machinists, chief carpenters, chief sailmakers, chief pharmacists and chief pay clerks, respectively, to rank with, but after, ensigns, and shall be designated commissioned warrant officers. On the Active List of the Navy, these commissioned warrant officers take precedence after ensigns, and over each other according to the dates of their commissions; in case the commissions of two or more of them are of the same date, then according to the order in which their names are borne upon the official Navy Register. Commissions give no additional right to quarters on board ship or to command. R. E. C.

WARRANTY, in the sale of lands, a covenant by the grantor binding himself and his heirs to defend the title against all persons so that if the grantee is evicted by paramount title he may recover upon the covenant. In sales of personal property a warranty is a statement or representation made as part of the contract of sale by which the seller undertakes to insure that the character or quality or title of the goods is as he then and there represents. In insurance it means an assertion or undertaking by the insured, the truth of which is a condition of liability on the part of the insurer. In the law of contracts generally it is an undertaking that some fact is or shall be as represented or promised.

WARREN, DR. JOHN COLLINS: Ether anesthesia for surgical operation first employed by. See MORTON, WILLIAM THOMAS GREEN.

WARREN, JOSEPH (1741-1775), American patriot, was born in Roxbury, Mass., June 11, 1741, and graduated in 1759 at Harvard. He settled in Boston to practice medicine and was prominent in the controversies between the colonists and the British government. In 1774 he drafted the Suffolk Resolves declaring that the king who violated charter rights forfeited the allegiance of the people. This position was approved by the First Continental Congress. After the BATTLE OF LEXINGTON he was tireless in urging military preparations in New England and was made a major-general of Massachusetts troops. He refused the chief command at Bunker Hill (see BUNKER HILL, BATTLE OF) where he was killed June 17, 1775.

WARREN, WHITNEY (1864-), American architect, was born in New York City, Jan. 29, 1864. He studied at the École des Beaux Arts in Paris, and began the practice of architecture in his native city. He became a member of the firm of Warren & Wetmore, who designed the Grand Central Terminus of the New York Central Railroad, New York City; the Michigan Central Station, Detroit; The Canadian Northern Station, Winnipeg; the Chelsea docks, New York City; and the Belmont, Vanderbilt, Biltmore, Ritz-Carlton, and Commodore Hotels, New York City, as well as many other important buildings. Warren was commissioned in 1920 to reconstruct the library of the University of Louvain, destroyed by the Germans in 1914.

WARREN, a city of northeastern Ohio, the county seat of Trumbull Co., situated on the Mahoning River, about 50 mi. southeast of Cleveland and 13 mi. north of Youngstown. The city is served by the Baltimore and Ohio, the Erie and the Pennsylvania railroads, bus lines and well-equipped airports. The surrounding country is largely given over to farming and dairying, and there are coal and iron deposits. Among the leading manufactures are steel products, electrical products, lumber, rubber, cement and bottles. In 1929 the value of the factory output was about \$37,000,000; the retail trade amounted to \$26,894,003. John Packard, pioneer manufacturer of automobiles, was born in Warren. For several years the city was the headquarters of the National Woman's Suffrage Association. In 1799 the first permanent settlement was made by a group of pioneers from Washington Co., Penn. The land at that time belonged to Connecticut. The town was named in honor of a surveyor, Moses Warren, of New Lyme, Conn., and the county, for Gov. Jonathan Trumbull of Connecticut. In 1834 Warren was chartered as a city. Pop. 1920, 27,050; 1930, 41,062.

WARREN, a borough and county seat of Warren Co., Pa., on the Allegheny River, 90 miles south of Buffalo, N.Y.; it is served by the Pennsylvania and the New York Central railways, motor buses and airport. This beautiful, fertile region is rich in oil and

gas, and power is furnished by Niagara Falls. Nearby are sulphur springs. Warren's altitude is 1,200 ft. In 1929 manufactures, chiefly oil, furniture, iron and steel, were valued at approximately \$22,000,000; the retail trade amounted to \$12,512,796. Warren is the gateway to a 390,000-acre Federal forest. Founded in 1795 by Gov. Mifflin and named for Gen. Joseph Warren, the borough was formed in 1832. Pop. 1920, 14,272; 1930, 14,863; 10% foreign-born.

WARREN, a town of eastern Rhode Island, in Bristol Co. It is situated at the mouth of the Warren River on Narragansett Bay, about 10 mi. southeast of Providence. The New York, New Haven and Hartford Railroad and bus lines afford means of transportation. The manufacture of cotton goods and twine, and oyster fishing are the leading industries. Warren was settled about 1635 and incorporated in 1746. It was named in honor of Admiral Sir Peter Warren. Pop. 1920, 7,841; 1930, 7,974.

WARRENSBURG, a city in western Missouri, the county seat of Johnson Co., situated 29 mi. west of Sedalia. It is served by the Missouri Pacific Railroad. Coal and blue sandstone are found in this region, and farming, stock-raising and dairying are engaged in extensively. The city has various manufacturing plants and a meat packing house. It is the seat of a State Teachers College. Warrensburg was founded in 1836. Pop. 1920, 4,811; 1930, 5,146.

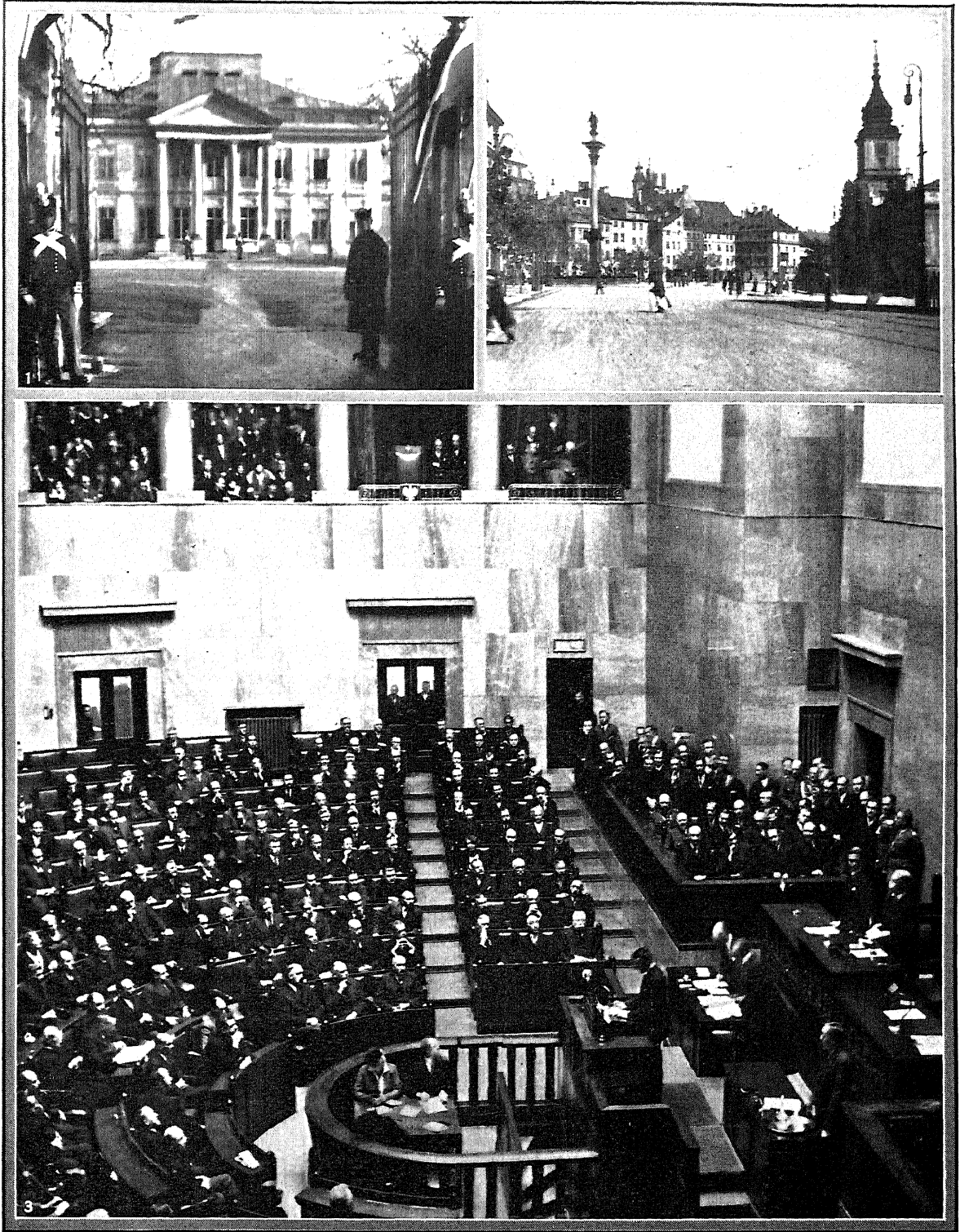
WARRINGTON, a municipal borough of Lancashire, England, situated on the Mersey between Manchester and Liverpool, 182 mi. northwest of London. Of British or earlier origin, the railways and regional coalfields have thoroughly industrialized it, and but little remains of the ancient town. The largely rebuilt, Decorated Church of St. Elphin is a fine cruciform structure, and the town hall is housed in a classic 18th century mansion set in what is now a public park. Here also are several old houses. Warrington is an important tanning center and also manufactures soap, glass, tools, wire and hoops. There are cotton mills and chemical works. Pop. 1921, 76,811; 1931, 79,322.

WARS, AMERICAN. See articles on: FRENCH AND INDIAN WAR; REVOLUTIONARY WAR; BARBARY WARS; WAR OF 1812; MEXICAN WAR; CIVIL WAR; SPANISH-AMERICAN WAR; BOXER REBELLION; WORLD WAR. See also TREATIES, UNITED STATES.

WARSAW, capital and chief city of Poland, situated on the Vistula about 400 mi. from Berlin and 700 mi. from Leningrad. The city covers an area of approximately 46 sq. mi.

The first historical records of Warsaw are to be found in the 13th century when it is mentioned as an unimportant district town in the Duchy of Mazovia. It had gained importance by 1569 when the joint Diet of Poland and Lithuania met at Warsaw. In 1596 King Sigismund III transferred the capital of Poland from Cracow to Warsaw. Under the reign of King Stanislaus Augustus a number of fine palaces were built and the city became a center of art, literature and science. Warsaw's central position,

WARSAW



COURTESY CONSULATE GENERAL OF POLAND

GOVERNMENTAL POLAND: VIEWS IN WARSAW

1. The Belvedere Palace, built in 1822, residence of Marshal Pilsudski.
2. Castle Square, showing column of King Sigismund III.
3. View of the Diet Chamber, showing the Polish Parliament in session.

with convenient means of communication, made it an important business and political center. It is the residence of the President of the Republic, the location of the Diet, ministries and other governing bodies, and also of the embassies, legations and consulates of foreign countries, and the seat of the archbishop of the Catholic Church and of the highest dignitaries of other religions. Warsaw has such educational institutions as a university, a polytechnical school, a school of agriculture, academy of commerce, an art academy and a music conservatory.

The city is composed of several districts. On the high left bank of the Vistula River is the "Old City," one of the most interesting districts of Warsaw. To the south of the castle are newer districts with all the aspects of a large city. On the right shore of the Vistula lies one of Warsaw's suburbs, Praga, chiefly a labor settlement. The Royal Castle, established in the latter part of the 13th century and one of the finest memorials of the past, was the residence of kings from 1596 up to the partitions of Poland. At present it is the home of the President. Warsaw has numerous churches, the most notable being the cathedral in the English Gothic style, the Church of the Bernardines and the Church of the Holy Cross. Among the other buildings the most important are the Belvedere Palace in Empire style, the residence of the highest state dignitaries; the Palace of Lazienki, built in the 18th century by King Stanislaus; the Saxon Palace, the former residence of the kings of the Saxon dynasty, as well as mansions of important families, the university, the polytechnic and the opera house. Beautiful parks such as the Ujazdow and the Skaryszew embellish the city.

Warsaw is an important industrial city with many machine, metal and glass factories and tanneries. It lies in the center of Europe on the great road leading from the west to the east. Est. pop. 1930, 1,109,478.

WARSAW, a city in northern Indiana, the county seat of Kosciusko Co., situated 40 mi. northwest of Fort Wayne. Two railroads serve the city. Warsaw is located in a grain growing region, and manufactures furniture and wooden products. Nearby is Winona Lake, an attractive summer resort. Pop. 1920, 5,478; 1930, 5,730.

WARSAW, GRAND DUCHY OF. After the **TREATY OF TILSIT** in 1807, Napoleon I established the Grand Duchy of Warsaw with an area of 1,860 square miles and a population of 2.4 millions. He simultaneously soothed the apprehensions of Alexander I of Russia by the assurance that he did not purport the revival of an independent Poland, and by presenting Russia with the district of Bialystok. The French Emperor conferred sovereignty over the new Duchy upon Frederick August, King of Saxony, and granted it a conservative constitution on July 22, 1807. Scarcely had the new state established some semblance of order when it was invaded by the Austrians in 1809, who captured Warsaw on April 2 after a brisk defence by Poniatowski. Increased Polish resistance

forced the Austrians to withdraw even before Napoleon's victory at Wagram, and the Peace of Vienna won western Galicia for the Duchy. The outbreak of war between France and Russia, Napoleon's march to Moscow, his defeat at the Berezina, the battle of Leipzig, the abdication of the Emperor, and eventually the Congress of Vienna constitute the steps which led up to the elimination of the Grand Duchy and the final partition of Poland in 1815. S. H. C.

WARSHIPS. From the earliest days of the fighting canoe constructed by hollowing out a tree log, down to the latest dreadnaught, there has been a steady improvement and development in fighting craft. The strategy and tactics of war have remained the same, whether canoe, galley, sailing ship or steam vessel; whether armored or unarmored. New weapons and new types of vessels have been constructed, claims for each made and antidotes for each required. For centuries, each nation having a desire for sea power or sea supremacy went its own way building vessels best suited to its own needs, at the same time keeping a watchful eye on possible enemies possessing navies. Great nations rose in power and influence and built navies to protect their coasts and seaborne commerce, and when defeated at sea decisively, gradually but surely lost their trade and influence.

It was not until 1890 when the late Rear Admiral A. T. Mahan, U.S. Navy, published his book, *The Influence of Sea Power Upon History*, that the general public realized at last that the profound determining influence of marine strength upon the great issues of the world had been overlooked. When this truth was realized, nations began to build navies accordingly. After the conclusion of the World War, and the knowledge of its lessons and the great cost of armament, both land and sea, the Washington Convention for the Limitation of Armaments was called in Nov. 1921.

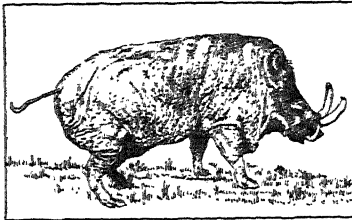
After lengthy debate, it became clear that the warships considered of importance to be limited were battleships and battle cruisers; cruisers of 10,000 tons and less; destroyers; submarines; aircraft carriers and aircraft. Unfortunately, an agreement only as to sizes and numbers of battleships and battle cruisers and as to total tonnage of aircraft carriers were the principal things decided upon. This agreement was signed by representatives of Great Britain, Japan, France, Italy, and the United States, and was to carry on until 1936.

Later developments called for the Conference at Geneva (*see* GENEVA CONFERENCE) in 1928, at which cruisers, principally, were considered. The Conference ended without result. Another attempt of limitation of naval armament was the LONDON NAVAL CONFERENCE of 1930. Here an agreement to last at least until 1936, was made by Great Britain, Japan and the United States as to further reduction in battleship numbers and tonnage; as to cruiser numbers by categories and classifications; as to destroyer tonnage, and as to submarine total tonnage, with minor

changes, particularly regarding aircraft and aircraft carriers. France and Italy were not parties to the London agreement but were expected to join after an agreement between the two nations. Classes of ships named in the London Treaty, therefore, are factors until 1936. See also DESTROYERS; DREADNAUGHTS; AIRCRAFT CARRIERS.

R. E. C.

WART HOG, a wild hog (*Phacochoerus*), two species of which inhabit central Africa. These wild swine are about 4½ ft. in length, almost hairless. ex-



WART HOG

cept for a mane along the spine, light in color, and rather slender and swift-footed. Their chief characteristic is the group of four enormous tusks which extend outside the mouth, then curve upward. These give the animal a superlatively ugly countenance, and equip him with weapons by which he can resist and frequently kill or disable a leopard or a lion, unless pounced on from the rear. However, wart hogs are not pugnacious or aggressive; they seek to avoid pursuit, and do not ravage crops or gardens, but quietly eat grass and dig roots on the bushy plains where they live.

E. I.

WARTON, THOMAS (1728-90), English scholar and poet laureate, was born at Basingstoke, Jan. 9, 1728. He was graduated at Trinity College, Oxford, in 1747, and remained at the university, serving as Professor of Poetry from 1757-67; in 1785 he was appointed Camden Professor of History. He gained a reputation as a critic by his *Observations on the Faerie Queene*, 1752. Among his other works are *History of English Poetry*, 1774-81, and an edition of Milton's *Poems upon Several Occasions*, 1785. Warton was poet laureate from 1785 until his death in London, May 21, 1790.

WARWICK, RICHARD BEAUCHAMP, EARL OF (1382-1439), English soldier and statesman, was born at Salwarp, Jan. 28, 1382. Two years after becoming earl in 1401, he fought on the side of the English in a war with Wales. He visited the Holy Land in 1408, returning to England two years later. King Henry V sent him on many diplomatic missions, and selected him to look after the education of his son. Warwick was present at the trial of Joan of Arc. He died at Rouen, April 30, 1439.

WARWICK, RICHARD NEVILLE, EARL OF (1428-71), English soldier and statesman, was born Nov. 22, 1428, the eldest son of Richard Neville, earl of Salisbury. Through his marriage with Anne, daughter of the earl of Warwick, he became earl of Warwick in 1449. In 1453 he joined Richard, duke

of York, in his struggles for the throne and succeeded in imprisoning King Henry. In 1460, in an attempt to rescue the king, the army of Queen Margaret defeated the York forces and captured and executed Richard. Warwick then supported Edward, the new duke of York and after a bold campaign, had him crowned Edward IV in 1461. Warwick became the center of power in the government.

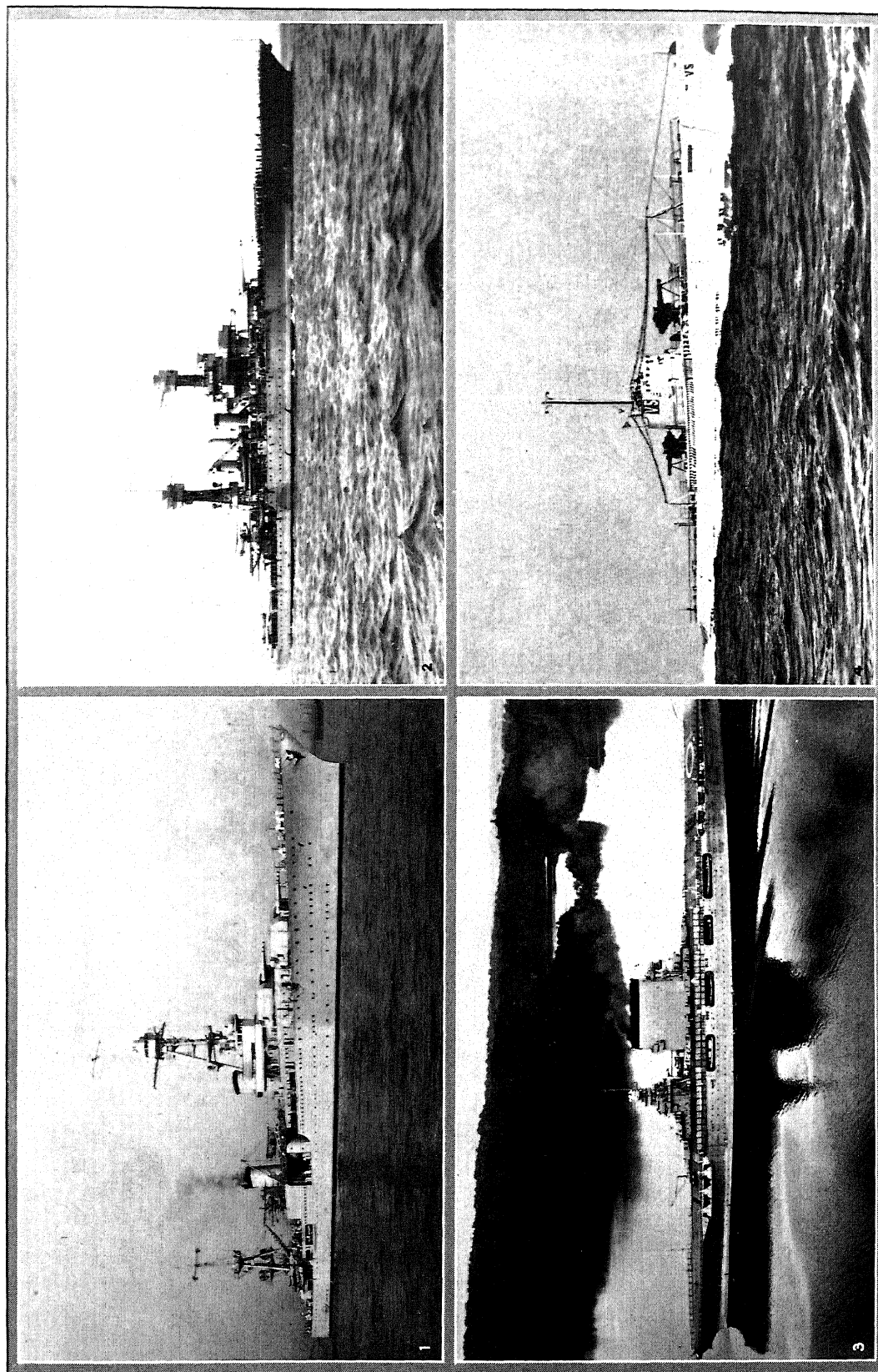
This power began to decline in 1464 when the king entered into a secret marriage thus disrupting Warwick's plans for an alliance with France. Again in 1466, Edward opposed Warwick's desire for a marriage between Isabel, his daughter, and George of Clarence, the king's brother. The following year, while Warwick was attempting an alliance with France, the king secretly formed a treaty with Burgundy. Warwick retaliated by arranging the secret marriage of Isabel and Clarence in 1469 and by invading England and capturing Edward. The following year, Edward again regained power and Warwick was forced to flee to France, only to return a few months later, defeat Edward and restore Henry VI to the throne. In 1471, Edward led a force into England, joined with Clarence, and on April 14 in the Battle of Barnet, defeated and killed Warwick.

WARWICK, a town of Kent Co., R.I., about 6 mi. south of Providence, on the Providence River and Narragansett Bay. It is served by the New Haven Railroad, motor bus lines and an airport. The town includes several manufacturing villages and summer resorts. The chief industry is textile printing. The retail trade in 1929 amounted to \$4,239,606. Warwick was settled in 1643 by Samuel Gorton and named for the Earl of Warwick. Four years later the settlement entered into a union with Providence, Newport and Portsmouth under the Warwick (or Williams) charter of 1644. **NATHANIEL GREENE**, of Revolutionary fame, was born in Warwick. Pop. 1920, 13,481; 1930, 23,196.

WARWICK CASTLE, the principal seat of the Earl of Warwick, situated at the southeast end of Warwick, on the River Avon, Warwickshire, England. The present structure dates from the 14th-15th centuries, though the castle's residential quarters were built chiefly by **FULKE GREVILLE** (1554-1623). Entrance is made from the lodge by a road cut in the rock to the Outer Court, continuing thence through a portcullis between the two ancient towers, Caesar's, 147 ft. high, and Guy's, 128 ft., to the Inner Court. The most interesting rooms—many of which had to be restored after a fire in 1871—are the Chapel, Great Hall, Cedar Drawing Room, Red Drawing Room, Armoury Passage, and the various state apartments, all containing relics, paintings and art treasures.

WASCO, a sub-tribe of the North American Indian upper Chinook, forming, with the Wishram, the most easterly branch of the Chinookan linguistic stock, being culturally and linguistically almost indistinguishable. They lived formerly on the south side of the Columbia River in Wasco co., Ore. They were a sedentary village people, largely dependent on fish for

WARSHIPS



1. 2. 4. COURTESY U. S. NAVY DEPARTMENT; 3. BUREAU OF AERONAUTICS, U. S. NAVY DEPARTMENT

TYPES OF WARSHIPS OF THE UNITED STATES NAVY

1. The cruiser U.S.S. *Houston*.
2. Dreadnaught U.S.S. *Maryland*.
3. Aircraft carrier U.S.S. *Lexington*, in Gatun Lake, Panama.
4. Submarine U.S.S. *V 5*.

their subsistence, though these were supplemented by roots and berries and to some extent by game. Fishing stations were considered personal property. They were excellent wood-carvers and makers of basketry. The semi-subterranean cedarbark covered house was used for winter and the tule or cedarbark shelter for summer. An important ceremony took place for the first capture of salmon; puberty ceremonies were observed for boys and girls. Head-flattening was practiced. Socially they were classified into three groups, chiefs, commoners and slaves, with the village as the important unit.

WASHBURN COLLEGE, at Topeka, Kans., is coeducational, privately controlled, and of Congregational origin. Chartered in 1865 as Lincoln College, it received its present name the following year. It had productive funds in 1931 amounting to \$1,351,957. The library contained 47,134 volumes. In 1931-32 there were 980 students, and a faculty of 74, headed by Pres. Parley Paul Womer.

WASHBURNE, ELIHU BENJAMIN (1816-87), American diplomat and public official, was born at Livermore, Me., Sept. 23, 1816. After law studies at Harvard he was admitted to the bar in 1840, and began practice at Galena, Ill. In 1852 he was elected as a Whig to the House of Representatives. He became a Republican in 1855 and was continuously a member of the House until 1869, when Grant appointed him Secretary of State. In Congress he was noted for his insistence upon strict national economy. He opposed grants of public lands and subsidies to railroads, and frequently opposed party measures which involved extravagant appropriations, such as river and harbor bills. He resigned after a week's service to become Minister to France. During the Franco-Prussian War he was the only foreign envoy to remain in the French capital, and turned the American legation into a refuge for Germans and other aliens during the siege of Paris. His courageous conduct won the approbation of both Bismarck and Thiers. He returned to the United States in 1877 to write his memoirs, *Recollections of a Minister to France*. He died at Chicago, Ill., Oct. 22, 1887.

WASH DRAWING, the older type of water-color painting, in which the color is laid on chiefly in washes. In producing a wash drawing, a careful and complete drawing is made before any color is applied. The first wash, of clear water, is spread over the entire drawing. Next a light wash is spread over all except the white spaces. The third wash, a little darker, is used to cover all of the drawing except the white portion and the part which is to be left the value of the first wash. The picture is thus built up by passing successive washes over everything that is to be darker than the preceding washes. When the series of washes are completed, the accents, final touches for emphasis, are added. Painting in water-color, which has had a tremendous development since the latter part of the 18th century, had its beginning in the wash method of applying water-color. Many of the brilliant water-color painters of the day ob-

tained their foundation in that medium through their mastery of wash drawings. **WINSLOW HOMER**, American water-color painter, won his first recognition with wash drawings. This medium also aided John Ward Dunsmore (1856-) to develop the characteristic richness of tone and color in his water-color paintings.

WASHED-OUT or **WIPED-OUT DRAWINGS**, a form of water-color painting, so called because the color after being applied is partially washed or wiped out. This process is used often to give soft color qualities on canvas-grained paper, and is especially suitable for producing dramatic sky effects. Frequently undertints of indelible inks are used in conjunction with washing out. The wash to be applied often has glycerine mixed with the water so that it will float on the surface of the paper rather than sink into it. A clean damp brush is generally used in washing-out.

WASHINGTON, BOOKER TALIAFERRO (c.1858-1915), American educator of the Negro, was born near Hale's Ford, Va., in 1858 or 1859. His mother was a mulatto slave and his father was white. He adopted the name of Washington when a young boy in school. Graduating from Hampton Institute in 1875, he then taught school at Malden, W. Va., for two years. From 1879-81 he was an instructor at Hampton and on the recommendation of the principal was asked to go to Tuskegee to open a school for Negroes for which the Alabama State legislature appropriated funds. He was the president of this school until his death. Washington early came to the definite conclusion that the Negro's development and progress would be best furthered by industrial training rather than by professional or classical education, and Tuskegee was developed on this basis. As early as 1895 Washington had gained national recognition as a leader in Negro education, as the result of an address on Negroes at the Atlanta Exposition, and he was invited to lecture all over the United States as well as abroad. Among his writings are *The Future of the American Negro*, 1899; *Up From Slavery*, (autobiography) 1901; and *The Man Farthest Down*, 1912. He died at Tuskegee, Nov. 14, 1915.

See E. J. Scott and L. B. Stowe, *Booker T. Washington*, 1916.

WASHINGTON, GEORGE (1732-99), first President of the United States, was born Feb. 22, 1732 (O.S., Feb. 11), in Washington Parish, Westmoreland Co., Va., on the Potomac River, descended from royalist gentry of Sulgrave Manor, Northamptonshire, England, and was the fourth, prosperous Virginia generation of his line.

From his mother, Mary Ball, he inherited the personal appearance of the Balls and an indomitable will, but he held more of the viewpoints of his successful, businesslike father and of his elder brothers. Little has been definitely established about George's early education; he probably had some schooling after the death of his father, Augustine, in 1743, but was largely self-educated.

Lawrence, his elder brother, in 1740, given the 2,500

acre "Washington," his father's second home, renamed his seat "Mount Vernon" in honor of his commander, Admiral Vernon; married Ann Fairfax; settled down to the life of a country squire and took his brother George to live with him in 1748. After it was decided that planter life promised better than the navy, the merchant shipping or anything in England, George was sent in March, 1748, with James Genn and George William Fairfax to survey lands of Lord Fairfax in the Shenandoah Valley.

He bought with his first earnings 550 acres of wild land and thus began the accumulation of land, always his desire and pleasure. He did much private and public surveying and in 1750 bought a plantation of 456 acres and two years later another of 552. In 1751, he went with Lawrence, then alarmingly ill, to Barbadoes, caught small-pox and was thereby marked for life. He became, after Lawrence's death in 1752, master of Mount Vernon.

At 19 Major and District Adjutant, and later one of four Adjutants General, he completed in the fall of 1753 a 500-mile journey at the request of Governor Dinwiddie, warned the French to cease invading English territory, and saw his report, on his return, distributed throughout the Colonies and England.

He led a few raw recruits toward the Ohio, killed or captured a small French reconnoitering patrol but in the face of much larger forces he was compelled to surrender his half-finished Ft. Necessity after an all-day fight in driving rain. Angered by the rule that Royal Commissions preceded Colonial, no matter what rank, Washington, now Colonel, resigned, but later accepted a cordial invitation from Gen. Braddock to serve on his staff and was a favorite adviser. In the Braddock disaster, the Virginia Colonel was a marvel of coolness and endurance. In the saddle for the first time after weeks of prostrating illness, he followed the General closely, had two horses shot under him and several bullets through his clothes, and was all over the field carrying orders, bringing up the Virginians, helping British officers to organize the rear-guard and to protect the wounded Commander, and finally reading the burial service over Braddock's body. He was on horseback or on his feet continuously for more than 48 hours and did not take off his clothes for seven days. Commissioned soon afterward "Colonel of the Virginia Regiment and Commander-in-chief of all the forces" of the Colony and "charged with full power and Authority to act defensively or offensively, as You shall think for the good and Welfare of the Service," this veteran of not quite 24, resting at Mount Vernon from the horrors, fatigue and sickness of the campaign, at once accepted the commission, began enlisting, organizing and training men, made a tour of the frontier forts, bought 650 fine beeves and gave his own bond for them, turned over his command to his second and set out for Boston to confer with Gov. Shirley of Massachusetts, Commander-in-chief of all the Colonies. Travelling with two aides and two servants, Col. Washington rode to Boston and back,

through Philadelphia, New York, New London, Newport and Providence, being officially and unofficially received as the hero of the Braddock tragedy, seeing hastily the tidewater strip of the Colonies and giving many people a chance to see him.

The next three years were spent chiefly in trying to defend hundreds of miles of forest frontier with a few hundred mutinous, poorly armed, poorly paid militia; in attending the meeting of Colonial Governors at Philadelphia; and in commanding the Virginia forces on the Forbes Expedition to capture Ft. Du Quesne. On a trip to Williamsburg to report to the Governor in 1758, this Soldier-planter wooed and won Mrs. Martha Dandridge Custis, a charming and rich widow, and they were married in January, 1759, after he resigned his commission. Defeated in 1757 in his first contest for a seat in the House of Burgesses, he was elected in 1758. When the Washingtons reached Williamsburg on their honeymoon, he took his seat as Burgess and received a vote of thanks for his military services. For 15 years this man, a foremost leader of his Colony at 27, was regularly a Burgess, and had the longest and least interrupted time of home residence of his whole life. He was a very busy man, for he managed his own and his wife's estates and those of her two surviving children. Before marriage he had owned 49 slaves and 5,000 acres of land, and the Custis estate brought into his hands 15,000 acres, 300 slaves and about \$100,000 in cash and securities, equally divided among his wife and her two children. Adjoining land was bought until Mount Vernon had 8,000 acres, but he was land-poor and slave-poor always. Still he lent and gave generously to relatives and friends, sometimes even by postponing pressing debts. Forsaking as wasteful of soil and of little profit the one-crop system in general use around him, after 1765 he grew barely enough tobacco to exchange for goods and produced chiefly wheat and flour. He read carefully all available books on agriculture and was one of the first scientific farmers on this continent. After the Revolution, he turned his fields to grazing as fast as he could grow sufficient grass, and made this interest second to wheat. He valued manure highly and used it to the utmost, invented a deep soil plow, imported a better one, chose carefully his breeding horses, cattle, sheep and hogs, and scrutinized every detail. In 1798, the Mount Vernon accounts showed a clear profit of about £900, a great achievement when it was obtained after supplying the family, entertaining innumerable guests and supporting 300 souls on the 8,000 acres. Half of Washington's 46 years of ownership were spent in absence on public services of the most demanding and burdensome kinds. In western lands, Washington received from Virginia 20,000 acres as bounty for services in the French and Indian wars and bought as much more from other officers and soldiers. This was the only real pay he ever received for public services; his salaries did not equal his expenses, and he refused all salary after 1775.

Washington expected from 1769 that the Colonies would be driven to use force in defending their rights, and he sanctioned it as a last resort but supported non-importation agreements as the best peaceable means of resistance. He and six others represented Virginia in the First Continental Congress, and Patrick Henry said to another member, "If you speak of solid information and sound judgment, Col. Washington is unquestionably the greatest man on the floor." From that meeting, this Virginia Planter-Colonel of 42 wrote to an old comrade that "No such thing (as independence) is desired by any thinking man in all North America," but he went back to urge Virginia to train and equip troops, and in the spring of 1776, he left his army long enough to go to Philadelphia and urge a declaration of independence.

He accepted the command of all colonial forces with sincere protests of unfitness, but he disproved his own misgivings by his skilful use of the limited resources of men and equipment with which he maintained the war. After being joyously received and entertained on his way to Boston, this "General and Commander-in-Chief of the armies of the United Colonies" took command July 3, 1775, made almost superhuman efforts in organizing, training and equipping his raw troops, and drove the British out of Boston in Mar., 1776. Around New York he baffled Howe's formidable forces, then the strongest ever in North America; skilfully extricated his army from the dangerous and unwise positions on Long Island; led Howe a merry dance around New Jersey and boldly threatened him until the British wasted in New York all the winter of 1776-77. Frederick the Great called this the most brilliant campaign of all history. The British finally reached Philadelphia only by the roundabout way of the Chesapeake in Nov., 1777. Washington's iron will, greatness of character, and refusal to yield under any misfortune, kept the revolutionary cause alive during that terrible winter at Valley Forge. With the help of Gen. Baron von Steuben, he brought out in the spring an army so rejuvenated, disciplined and trained as to drive Clinton's army from Philadelphia to New York and almost to destroy it. Holding with dogged determination to West Point, and thereby keeping a much larger British force busy watching him, Washington sent some of his best generals and his most dependable troops south, where they finally drove the British out of North Carolina and up into Virginia, where he joined them to besiege and capture Cornwallis and his army at Yorktown, in Oct., 1781. Cornwallis praised very highly the skill and wisdom of this campaign. It practically ended the war, and Washington was able to resign his command at Annapolis in Dec., 1782. But he was still the chief rallying, uniting force of the Nation and worked indefatigably for a stronger union. As Chairman of the Convention of 1787, which he had helped bring about, he had more influence than any other one member in securing agreement upon a real national government. Again his advocacy was predominant

in the Virginia Convention and secured the ratification by Virginia of the Federal Constitution. Finally, elected unanimously as the first President of his Nation, he borrowed £10,000 and set out for New York on his last term of public office. His administration, 1789-97, established the new Government on a firm foundation, gave it financial stability through Hamilton's economic measures, began the diplomatic and commercial fight for real and full independence from foreign nations, and by promptly and vigorously combatting the Whiskey Rebellion and other challenges of its authority, gave it compulsive force in domestic affairs. He refused to allow himself to be considered for a third term, retired to Mount Vernon in March, 1797, and died there Dec. 14, 1799.

Despite a certain austerity in his temperament Washington keenly enjoyed dancing, hunting, dining, drinking, good conversation and the theater. Less gifted than Hamilton and less learned than Jefferson he surpassed them both in sound judgment and forceful leadership. He spent a long and full life in increasing public activity, overcame one crisis after another, growing constantly in stature, and proved himself one of the greatest men of the English speaking peoples in his influence on his own and subsequent generations.

E. J. W.

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WASHINGTON, MARTHA DANDRIDGE CUSTIS (1731-1802), wife of George Washington, was born June 21, 1731, in New Kent Co., Va. She was educated at home and in 1749 was married to Daniel Parke Custis, and later inherited from him one of the largest fortunes in Virginia. Widowed in 1757, she was married to George Washington in Jan. 1759, taking up life with him at Mount Vernon. She was 57 when she became mistress of the executive mansion, first at New York City and later at Philadelphia. As the first lady of the land she deputed herself with a fastidious correctness. After Washington retired from public life she spent the remainder of her days at Mount Vernon, surviving her husband two and one-half years. She died there, May 22, 1802.

WASHINGTON, the most northwestern state of the United States, popularly called the "Evergreen State," and also the "Chinook State." It is situated between 45° 32' and 49° N. lat. and 116° 57' and 124° 48' W. long. On the north Washington is bounded by British Columbia, except in the northwest where a deep inlet made up of the straits of Georgia, Haro, and Juan de Fuca separate the state from Vancouver Island. On the east Washington is bounded



WASHINGTON STATE SEAL

by Idaho, on the south by Oregon from which it is separated largely by the Columbia River and on the west by the Pacific Ocean. Washington comprises an area of 69,127 sq. mi., inclusive of 2,291 sq. mi. of water surface. The state is somewhat rectangular in shape, with a maximum breadth of 360 mi. from east to west and 240 mi. from north to south. In size Washington ranks nineteenth among the states of the Union.

Surface Features. Washington is divided longitudinally into the Pacific border province, the Cascade Mountains, and Columbia Plateau. The mean elevation for the state is 1,700 ft. and its relief varies from sea level to 14,408 ft. on the summit of Mt. Rainier.

The Cascade Mountains which lie between the Pacific border and the Columbia Plateau, extend from the Canadian line southward into Oregon. That part above 47°30' is sometimes called a plateau because of the striking uniformity of its crestline although the summits are extremely rugged and the slopes steep. Most of the peaks owe their architectural detail to glaciation. Their average height varies from 6,000 to 8,500 ft., but a few isolated peaks rise much higher. Mt. Baker is 10,827 ft. and Glacier Peak 10,436 ft. The valleys which separate the ridges are steep and usually are 2,500 to 3,000 ft. deep. The trough containing Lake Chelan is more than 5,000 ft. deep.

Below 47°30' the Cascades consist chiefly of volcanic rocks and the dominating peaks are symmetrical cones of great height. Mt. St. Helens is 10,000 ft., Mt. Adams, 12,470 ft. and Mt. Rainier, 14,408 ft. The range ends in Washington with the great transverse valley of the Columbia River.

The Pacific border province consists of a low coastal plain 10 to 20 mi. wide with a shoreline measuring 1,037 mi.; a line of coast ranges comprising the Olympic Mountains and part of the Oregon Coast range; and the Puget Sound valley between the coast ranges and the Cascades. This valley is about 500 ft. above sea level, 50 mi. wide, and terminates at the north with Puget Sound. It is an important agricultural section and densely populated. The Olympic Mountains in the northwestern promontory are completely isolated from the other coast ranges by a gap 30 mi. wide through which the Chehalis River flows to the sea. They cover an area of about 4,000 sq. mi. and have an average height of 4,500 to 5,000 ft., above which rise exceedingly sharp peaks such as Mt. Olympus, 8,200 ft. high.

The Columbia Plateau as a whole covers eastern Washington and Oregon and a part of southern Idaho. It is built up of nearly horizontal sheets of lava and has a flat or rolling surface with variations such as outlying ranges and protruding volcanic craters. In Washington it has several subdivisions. The Walla Walla section includes the Palouse Co. in the valley of the Palouse River and the Coulee district on the inside curve of the Columbia River. The latter region is distinguished by scablands which are strips of almost bare basalt channeled by canyons known as coulees. The Grand Coulee is 800 to 900 ft. deep and from 2

to 4 mi. wide. Between the Columbia River and the Cascades is the Yakima district, the chief irrigated area in the state. North of the Columbia a row of mountain ranges belonging to the Rockies extends westward from Idaho and connects with the Cascades.

The drainage of the state is concentrated in the Columbia River which empties into the Pacific.

Climate. Because of the division of the state by the lofty Cascade ranges into a coastal and an interior region, Washington exhibits two distinct types of climate. The coastal area possesses a mild, humid and equable climate, while the interior region is subject to wide extremes and is predominantly dry. The mean annual temperature of the state is 48.2° F., ranging from 50° F. on the coast to 46° F. in the interior basin. During the period 1890-1930 the highest temperature recorded in Washington was 116° F. and the lowest, -36° F. The average annual precipitation is 37.9 in., varying from 120 in. in the Olympics, the wettest area in the United States, to as low as 12 in. in the eastern basin. The average growing season at Seattle is 249 days, and at Spokane, 182 days.

Forests and Parks. Of an original forested area of 18,000,000 acres approximately 11,541,000 acres of first- and second-growth timber of merchantable size are now standing. There are large areas of virgin forest and reforestation is extensive. Except in certain belts western Washington is covered with luxuriant forests in which Douglas fir predominates, often forming as much as 90% of the forest. Giant cedar, western hemlock, red alder, and broadleaf maple are also found in these regions. In the bottomlands grand fir, Oregon ash, cottonwood, western dogwood and crab apple are characteristic. Up to approximately 6,000 ft. in the Olympics in the western part is a mixed mountain forest of western white pine, lodgepole pine, grand fir, western hemlock, Douglas fir, silver fir and noble fir. In the eastern section Englemann spruce and western larch replace the last two species. Forests of western yellow pine with an admixture of Douglas fir occupy the eastern slope of the Cascades, the lower levels of the Blue Mountains, and nearly all of northeastern Washington. Characteristic trees of the subalpine forests of the Cascades, Olympics, Blue Mountains and of localized sections in the northeastern portion of the state are alpine fir, Alaska cedar, *Chamaecyparis-nootkatensis*, mountain hemlock, and white bark pine. Ten national forests, chiefly in the Cascades and the Olympics, in 1930 covered a total area of 9,564,576 acres in the state of Washington. These forests are much used for camping and other recreational purposes. Chelan National Forest adjoining the Canadian boundary in the Cascades is the largest, 1,796,644 acres, and ranges in elevation from about 3,000 ft. to nearly 7,000 ft. It includes the famous Lake Chelan, a rival of Lake Brienz of Switzerland.

MOUNT RAINIER NATIONAL PARK is located in Rainier National Forest in the Cascades and MOUNT OLYMPUS NATIONAL MONUMENT in Olympic National

Forest. In southwestern Washington, three state forests with a total area of 63,589 acres have been set aside. The 19 state parks include lakes, forests, islands and deep-sea fishing grounds. Many have camp grounds with community kitchens. State Monuments are Mathilda N. Jackson Memorial, Rigney, a state clubhouse of the Pioneers' Association of Pierce County, and Spokane Plains Battlefield Monument.

Minerals and Mining. Although Washington possesses widely distributed ore deposits yielding limited quantities of gold, silver, copper, lead, zinc and mercury, and also various other minerals, the most important single item of output in 1930 was bituminous coal, mined mostly in the west central part of the state. With mineral productions for 1929 amounting to \$22,435,359, Washington stood thirty-first among the states, ranking first in magnesite and fourth in sodium carbonate. The leading products in order of value were coal, 2,521,327 tons, \$8,647,000; cement, about \$5,000,000; clay products, \$2,566,891; sand and gravel, 5,391,693 tons, \$2,138,019; and stone, 1,673,390 tons, \$1,960,460, including limestone, \$802,701, magnesite about \$650,000, and basalt, \$311,867. During 1929 121 mines and quarries gave employment to 4,110 persons who received \$6,703,380 in salaries and wages.

Soil. Western and eastern Washington present two distinct types of soil; the soils of the area on the Pacific side of the Cascades are largely of glacial origin, while those of the Inland Empire region are chiefly volcanic. The soil of the uplands of western Washington is made up of clay, sand and gravel, but that of the valleys and depressions contains in addition much vegetable matter. In the Puget Sound district the bottomlands are covered with rich alluvium. The plains of eastern Washington, especially the Columbia plateau, are more or less deeply covered with volcanic ash and decomposed lava which form highly fertile soils. In districts where the rainfall is sufficient or where irrigation has been established these soils are very productive.

Agriculture. Wheat and apples are the outstanding crops; other important farm products include hay and various grains, fruits and vegetables.

In 1930 13,533,778 ac. or 31.6% of the entire land area was in farms, 70,904 in number, with an average size per farm of 190.9 ac. and an average value per acre of \$57.17. Of the farm area 6,275,350 ac. was crop land; 6,240,812 ac., pasture land; and 386,427 ac., woodland. The total value of farm property was \$887,833,763, of which \$773,662,602 was represented by land and buildings; \$50,511,853, by implements and machinery; and \$63,659,308, by domestic animals.

According to the census of 1930 Washington produced in 1929 field crops to the value of \$144,865,829, ranking twenty-seventh among the states. It stood first in apples, raspberries and blackberries, second in pears, third in plums and prunes, cherries and walnuts, fourth in lettuce, sixth in wheat, ninth in grapes, and tenth in peaches and strawberries. The chief crops were grains \$53,586,710, fruits and nuts \$48,

157,908, hay \$24,451,501 and vegetables \$17,622,551. The leading grain was wheat, 42,588,762 bu. grown on 2,295,042 ac. Among other grains were oats, 5,776,632 bu., and barley, 1,539,224 bu.

The principal orchard crops were apples, 25,782,252 bu.; pears, 2,682,295 bu.; plums and prunes, 1,777,656 bu.; peaches, 1,163,754 bu.; cherries, 554,920 bu., and apricots, 253,774 bu. Other fruit and nut crops included strawberries, 13,833,977 qts.; raspberries, 10,761,045 qts.; blackberries, 7,523,030 qts.; loganberries, 1,861,613 qts.; cranberries, 1,101,390 qts.; grapes, 12,070,827 lbs., and walnuts 139,400 lbs. Of the hay crop of 1,474,663 tons, alfalfa furnished 558,008 tons. Among the vegetables were potatoes \$10,423,089, lettuce \$1,057,720, and peas \$458,710.

Farm products sold by cooperative marketing rose from \$15,356,226 in 1919 to \$33,338,231 in 1929, and farm supplies purchased by this method from \$2,710,202 to \$9,005,416. Farm machinery and equipment in 1930 included 55,995 automobiles, 18,836 motor trucks, 8,388 tractors, 15,788 electric motors, and 18,762 stationary gas engines.

Irrigation. Although irrigation was established early in the development of the state, the periods of greatest expansion were from 1890 to 1900 and during the World War. In the Census of 1930 irrigation operations were separately reported for 22 of the state's 39 counties. The chief irrigated areas are devoted mostly to fruit-growing. These have nearly all been developed along tributaries of the Columbia in the central part of the state, notably in the Yakima Valley which contains about two-thirds of the total irrigated acreage of the state. Washington stood fifth among the states in value of irrigated farms and seventh in amount invested in irrigation enterprises. Irrigated farms comprised 22.5% of the number and 25% of the value of all farms in Washington.

The total number of irrigated farms in 1930 was 15,949, with an aggregate area of 1,923,337 ac., of which 499,283 ac. were irrigated. Including land and buildings the value of all irrigated farms was \$195,394,180, or an average of \$101.59 per ac. The total investment in irrigation enterprises to 1930 was \$40,561,895, and the average cost of maintenance and operation for 1929 was \$4.14 per ac.

Animal Industry. Dairying and poultry-raising are the chief animal industries. According to the census of 1930, Washington ranked thirty-second among the states in total value, \$63,659,308, of domestic animals on farms. Among these were cattle, 624,737, valued at \$35,579,750; horses, 182,503, \$10,362,384; mules, 22,174, \$1,258,161; sheep, 1,142,603, \$8,178,099, and swine, 186,275, \$2,372,346.

Of the cows on farms, 298,623 were kept mainly for milk production and 61,529 mainly for beef production. In 1929, 180,104,032 gals. of milk were produced; the total value of dairy products sold was \$28,157,388. The value of all poultry raised was \$11,050,052. The number and value of the chief kinds were: chickens, 11,063,096, \$10,100,868; turkeys, 251,713,

\$789,361; ducks, 74,853, \$85,641, and geese, 35,084, \$74,182. The chickens sold, 5,200,323 in number, were valued at \$4,483,686. Of 71,429,018 doz. chicken eggs produced, valued at \$22,575,430, 61,107,503 doz., with a value of \$19,389,633, were marketed. The wool clip, 5,484,641 lbs., was valued at \$1,456,973. Honey, amounting to 1,342,866 lbs. valued at \$169,183, was produced from 34,569 hives.

Fisheries. In 1930, Washington ranked fourth among the states in the yearly value of its commercial fisheries, the total catch amounting to 152,224,000 lbs., valued at \$9,563,000. Salmon was by far the most valuable fish taken, followed by cod, halibut, flounder and mackerel. The inland streams are noted for trout fishing and the lakes for trout and other game fish. In 1930, the state issued 212,790 fishing licenses, receiving \$402,591 in fees. Twenty-seven fish hatcheries were operated during the year at a cost of \$151,076, and with an output of 28,936,067 trout and 137,478,714 commercial species, mostly salmon.

The most important salmon-egg collecting and hatching stations of the U.S. Bureau of Fisheries are in this state, and ten stations and substations were operating in 1930. Heavy plantings of salmon were made in state waters during the year, including 6,485,750 chinook, 24,409,000 chum, 6,232,700 silver, 15,165,190 sockeye, 3,323,300 humpback and 2,967,260 steelhead; as well as 2,422,000 black-spotted trout and 347,000 other trout.

Transportation. The state is favored with excellent transportation facilities, both by land and water. The Columbia and Snake rivers and their tributaries are navigable for boats of light draught, while Puget Sound, with its numerous inlets and deep channel, is a natural terminus both for coastwise and ocean-going steamship lines and transcontinental railroads. The cities of Seattle and Tacoma on Puget Sound are the chief ports of Washington and among the leading seaports on the Pacific coast. In 1930 the total steam railway mileage was 5,539, with the North-

steadily extended. On Jan. 1, 1930 there were 60,640 mi. of highways, including 16,718 mi. of surfaced roads and 2,845 mi. of improved state highways. During 1929, highway expenditures were \$21,709,216, of which \$12,734,216 was paid by the state and \$8,975,000 by county and local governments. Gasoline consumption during 1930 aggregated 271,167,000 gals. The state gasoline tax that year produced an income of \$7,253,249 as against \$3,482,093 in 1926. Motor vehicle registrations were 446,062 in 1930 compared with 328,442 in 1925. The growth of transportation by truck is indicated by registrations, which rose from 46,990 in 1925 to 63,188 in 1930. During the same period the number of buses in operation in the state increased from 1,436 to 2,281, or about 60%.

Manufactures. Washington has substantial manufactures based chiefly upon its extensive forest, farm and livestock resources.

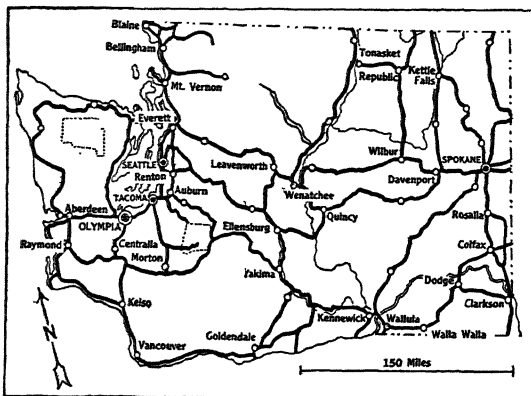
According to the Census of 1930 Washington with manufactures for 1929 valued at \$795,561,861 stood eighteenth among the states. Its 3,672 establishments gave employment to 13,910 officers and employees, who received \$35,904,583 in salaries, and to 114,830 wage earners, who were paid \$160,670,891 in wages. These factories used a total of 814,891 horse power, expended \$13,470,042 for fuel and power, and \$414,942,984 for materials and supplies, and added by the process of manufacture \$367,148,835 to the value of their output.

In this output there were 103 separately enumerated manufactures. The state led all others in the production of lumber and ranked second in canning fish, fifth in wood pulp, sixth in flour, eighth in planing mill products and tenth in canning fruits and vegetables. The outstanding product was lumber. This, valued at \$262,621,468, comprised 33% of the total manufactures of the state. Other important manufactures in order of value were flour, \$45,563,866; packed meats, \$34,412,937; paper, \$28,429,104; printing and publishing, \$27,882,844; planing mill products, \$23,463,304; canned fruits and vegetables, \$22,233,749; bread, \$20,490,217, and wood pulp, \$18,664,992.

The chief manufacturing cities, with value of output, were Seattle, \$199,570,928; Tacoma, \$140,507,198; Spokane, \$46,395,123; Everett, \$23,085,155; Bellingham, \$20,187,029; Hoquiam, \$17,699,670; Aberdeen, \$17,252,255, and Vancouver, \$13,076,318.

Commerce. According to the census of 1930, there were in 1929 2,631 wholesaling establishments in Washington with total sales of \$1,147,057,439. These organizations gave full-time employment to 30,391 men and women whose annual salaries and wages aggregated \$51,100,990. The chief wholesaling center is Seattle, with Spokane, Tacoma and Colfax also important.

The total sales of the 22,209 retail stores amounted to \$774,340,348. Sales per store averaged \$34,866; sales per capita, which were \$495.29, were surpassed only in California, New York State and Nevada.



WASHINGTON STATE ROADS

ern Pacific, the Great Northern, the Milwaukee, the Oregon and Washington and the Spokane, Portland and Seattle the most important lines.

The highway system has been well maintained and

CHIEF RETAIL DISTRIBUTING GROUPS

Group	No. of Stores	Sales	% of Total
Food	6,427	\$172,498,457	22.28
Automotive	4,728	168,328,596	21.74
General Mdse.	1,553	144,885,265	18.68
Apparel	1,422	49,490,717	6.38
Furn. & Household .	679	29,259,422	3.77
Lumber & Bldg. .	1,170	52,968,427	6.84
All other stores . .	6,130	157,109,423	20.31
Total, all stores .	22,209	\$774,340,348	100.00

Seattle, the principal port, handled water-borne commerce amounting to 10,117,554 tons, with a value of \$775,924,995. Tacoma, with water-borne traffic valued at \$185,869,081, was also important. Logs, piling and other lumber, oil, fish and wheat were the most important items.

Finance and Banking. The value of all taxable property in 1929 was \$1,216,089,557. The state's bonded debt in 1930 was only \$13,000,000. Total state revenues in 1928 were \$35,292,189; total disbursements, \$31,693,668. The chief sources of income were property taxes, \$16,802,800 and licenses, \$13,061,000. This item included taxes on corporations, insurance companies, motor vehicles and gasoline sales, \$3,878,096. The principal payments were for highways, \$10,024,476, educational aid, \$8,555,666 and permanent improvements, \$2,478,932.

There were 331 banks in Washington in 1930. Of these, 105 were national banks and 226 trust companies and state banks. Their total capital was \$41,767,000; their surplus and undivided profits, \$23,759,000. Total resources were \$583,560,000, with loans and discounts aggregating \$296,409,000. Demand and time deposits totaled \$447,996,000. Per capita demand and time deposits were \$286.26; per capita savings deposits, \$141.57. The total savings of \$221,563,000 were owned by 527,309 depositors. National bank circulation aggregated \$11,673,000.

Government. The law-making body of Washington is the legislature consisting of a Senate composed of 42 members and a House of Representatives of 97 members, the former elected for terms of four years and the latter for terms of two years. They meet in biennial sessions limited in duration to 60 days. The chief executive is the governor elected for terms of four years at a salary of \$6,000 per year. Other executive officers are the lieutenant governor, secretary of state, treasurer, auditor, attorney-general, superintendent of public instruction, and commissioner of public lands. Judicial power is vested in a supreme court, a superior court, and in justices of the peace and inferior courts. The supreme court consists of nine judges elected for terms of six years at salaries of \$6,000 per year.

Social Welfare Institutions. State institutions are supervised by the Board of Business Control, the chairman being appointed by the governor. There are schools for the deaf and blind at Vancouver, a training school for boys at Chehalis and a state school for girls at Grand Mound. A custodial school for feeble-minded is at Medical Lake. Hospitals for the

insane are located at Ft. Steilacoom, Sedro Woolley, and Medical Lake. The soldiers' home is at Orting and the veterans' home at Retsil; the reformatory at Monroe and the penitentiary at Walla Walla.

Education. The first schools were private and denominational schools in existence prior to 1854 when public schools were introduced by law. The first public high school was opened in 1883 in Seattle. When Washington was admitted into the union in 1889, there were 1,161 school districts. By 1928 there were 2,941 public school buildings, with 260,764 enrolled pupils in the public kindergartens and elementary schools, and 78,237 pupils in the public secondary schools. All children from 8 to 15 years of age are required to attend school the full school year.

The number of persons from 5 to 20 years of age attending school in 1930 was 331,644, or 75.7% of the population within the ages specified, as compared with 257,332, or 69%, in 1920. The number of persons, 10 years and over, unable to read and write in 1930 was 13,458, giving an illiteracy percentage of 1%, as compared with 18,526 illiterates, or 1.7%, in 1920. Among the foreign-born whites, 10 years and over, there were 7,103 illiterates, or 2.9% in 1930, as compared with 11,630, or 4.7%, in 1920.

Among the institutions of higher learning, the state maintains the University of Washington at Seattle, the State College at Pullman, and normal schools at Bellingham, Ellensburg and Cheney. The more widely known private educational institutions are Walla Walla College at College Place, Gonzaga University at Spokane, College of Puget Sound at Tacoma, and Whitman College at Walla Walla. The State Library Committee has its headquarters in the State Library at Olympia.

Population. In 1930 Washington ranked thirtieth among the states with a population of 1,563,396 or an average of 23.4 per sq. mi., an increase of 206,775 or 15.2% over 1920. The population rose from 11,594 in 1860 to 357,232 in 1890, 518,103 in 1900, 1,141,990 in 1910, and 1,356,621 in 1920. In 1930 there were 1,521,099 or 97.3% whites, 17,837 or 1.1% Japanese, 11,253 or 0.7% Indians, and 6,840 or 0.4% Negroes. Of the whites, 1,276,843 were native-born and 244,256 were foreign-born, a decrease in the latter of 5,799 since 1920. Of the total foreign stock, including foreign-born, foreign and mixed parentage, 99,069 or 15.3% were Canadian (other than French); 87,130 or 13.5%, German; 77,450 or 12.0%, Norwegian; 76,843 or 11.9%, Swedish; 57,989 or 9.0%, English. The urban population was 884,539 or 56.6% of the total, an increase of 135,804 or 18.1% from 1920; the rural population was 678,857 or 43.4% of the total, an increase of 70,971 or 11.7% since 1920. There were in 1930 three cities of 100,000 and upwards: Seattle, 365,583; Spokane, 115,514; Tacoma, 106,817.

Occupations. In 1930 664,730 persons, or 42.5% of the population, were gainful workers 10 years old or older; 80.9% of these were males and 19.1% were

females; 76.1% were native white; 21.2% foreign-born white; 0.6% Negro, and 2.2% other races. Among the principal occupations, with number of workers, were farmers, 63,399, and farm wage workers, 34,474; factory operatives, 27,826 men and 6,700 women; factory laborers, 33,084; salespersons, 23,928 men and 9,218 women; clerks, 17,666 men and 9,463 women; lumbermen, 24,931; retail dealers, 23,997; servants, 22,671; carpenters, 17,143; school teachers, 2,974 men and 11,790 women; chauffeurs, 14,259; stenographers, 11,689, and bookkeepers and cashiers, 11,615.

HISTORY

Washington was first seen by white men in June, 1774, when Juan Perez, sailing south along the Pacific coast from the northerly point of 55° latitude, saw in the distance and named Santa Rosalia the snow-clad peak now called Mt. Olympus. The first European to land was another Spaniard, Bruno Heceta, also Oregon's first visitor, six of whose men were killed in a fight with Indians. Capt. Cook on his last voyage, 1778, coasted the shores of Washington. Another Englishman, Capt. John Meares, 10 years later discovered and named San Juan Strait, and, while searching for the rumored "river of the west," entered the mouth of the Columbia, but mistook it for an arm of the sea. In 1792 Capt. Robert Gray discovered and named the Columbia River. During the period 1792-94 Capt. George Vancouver discovered, explored and named Puget Sound. The Lewis and Clark expedition entered Washington in 1805 by the Snake River, followed it to the Columbia and that stream to the sea. The first settlement was made in 1810 when David Thompson, agent of the British Northwest Company, built Spokane House at the junction of the Spokane and Little Spokane rivers. During the War of 1812 American interests withdrew from the Northwest country and the HUDSON'S BAY COMPANY ruled the entire region, Dr. John McLoughlin being its governor and chief factor west of the mountains. He established a number of fur trading stations, encouraged British settlers and developed farms. From 1818 until 1846 Great Britain and the United States by treaty held the Northwest country in joint occupation. Dr. and Mrs. Marcus Whitman founded a mission settlement in 1836 near Walla Walla; in the winter of 1842-43 Whitman made an heroic journey over the mountains and plains to Washington and other cities to arouse interest in the Northwest and to convince public men of the importance of bringing it into the United States. Two years later the present northern boundary was established by treaty with Great Britain. Washington was included in Oregon until 1853, when it was organized as a separate territory. Its present boundaries were not fixed until the Territory of Idaho was carved from it in 1863. The first permanent American settlement was made at Tumwater in Puget Sound in 1845; two miles away in 1847 another town was started which later became Olympia and the capital of the territory and the state. Washington, with a

population of 349,000, was admitted to the Union Nov. 11, 1889. Since 1900, Washington has more often shown political preference for the Republican than the Democratic party. In 1932, however, the state returned a Democratic vote, and elected Clarence D. Martin governor and Homer T. Bone senator.

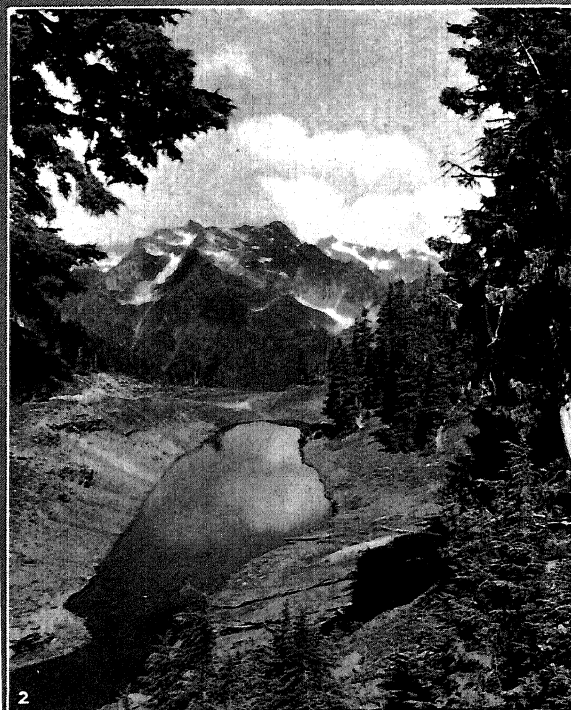
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WASHINGTON, capital city of the United States, and 14th city in population, situated on the left bank of the Potomac River, at the head of navigation, 40 mi. southwest of Baltimore and 226 mi. southwest of New York City. The observatory of the Smithsonian Institution, located in the Capital City, is at 38° 53' 17" N. lat. and 77° 1' 34" W. long. The city is coextensive with the Federal DISTRICT OF COLUMBIA and occupies a land area of 62 sq. mi. The population in 1920 was 437,571; in 1930, 486,869, an increase of 11.3% in 10 years. Negroes totalled 120,324. Washington records an average temperature of 33° F. in January, of 77° F. in July. The average annual precipitation is 42.2 in.

Geographic Setting. The Potomac flows past the west and south sides of the city. Traversing the northwest section is Rock Creek, entering the Potomac below Georgetown. Another tributary, the Anacostia, or East Branch, flows from the northeast and joins the Potomac below the United States Navy Yard and Potomac Park. Along the picturesque wooded left bank the ground is low, generally rising to a maximum of 100 ft. Outside the capital and encircling it is a series of wooded hills, the rim of a plateau rising to an elevation of between 300 and 420 ft. The site was ideal for its purposes, and in recognition of its promise Washington in 1791 appointed Major PIERRE CHARLES L'ENFANT, a French engineer, to draw up a street plan for the capital.

Streets and Buildings. In the main, L'Enfant's plan consisting of streets running to the direct points of the compass, cut diagonally by avenues radiating from the Capitol and the White House, has been preserved by his successors. The result is a magnificent city of broad vistas and classic structures, enhanced by landscape gardening; the few architectural blemishes and overcrowded sections are in process of elimination under direction of the National Capital Park and Planning Commission. Streets extending east and west are named by letters of the alphabet, and those north and south are numbered. The 21 diagonal avenues radiating from the Capitol and the White House have been named after the states. Added simplicity is lent to the street plan by its division into four quarters, N.W., S.W., N.E. and S.E.; the lines of demarcation are North Capitol, East Capitol and South Capitol streets and the Mall Parkway, intercepting at Capitol Hill. The Chief "down-town" thoroughfares are Pennsylvania Avenue, running from the Capitol to the White House and beyond; F and G streets, and 7th, 9th and 14th streets. The principal residential streets are located in the N.W. quarter. From the Capitol westward to the Potomac

WASHINGTON

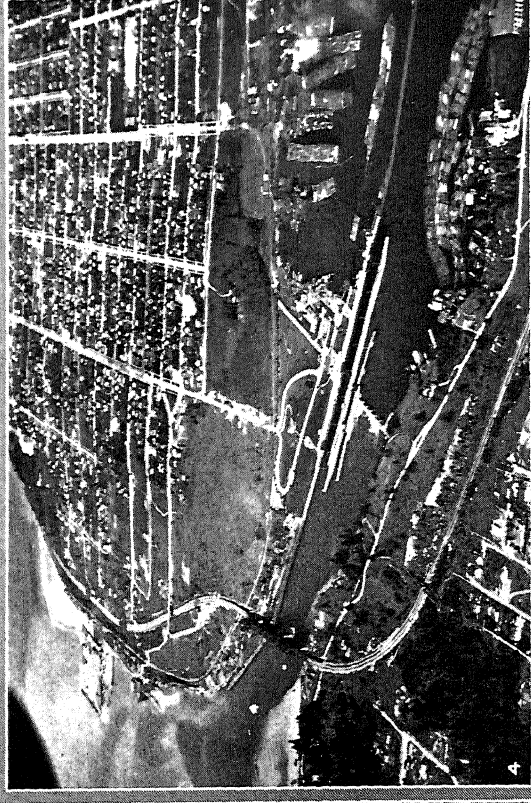
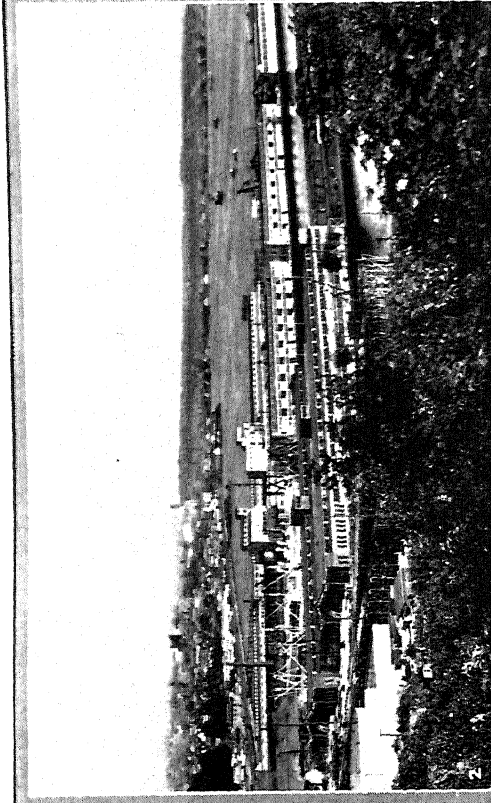
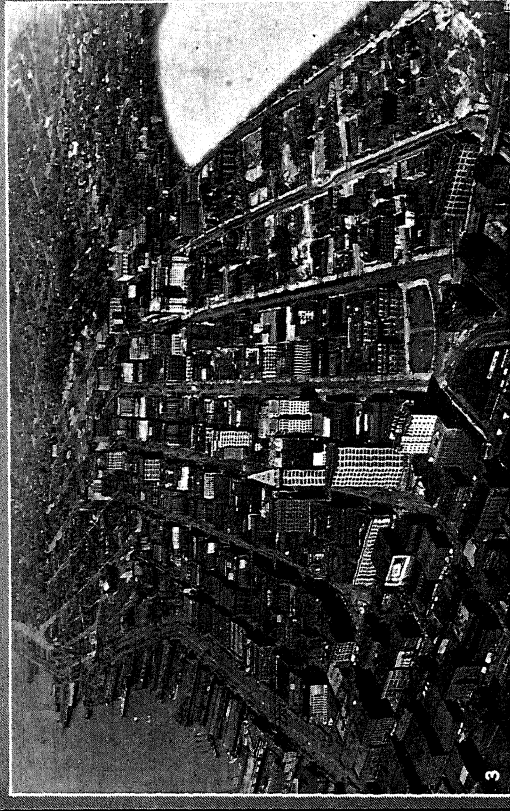
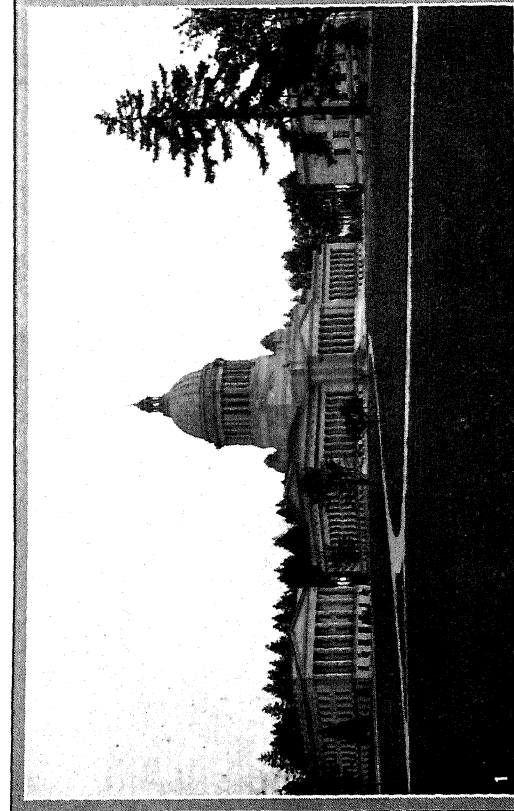


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CHARACTERISTIC WASHINGTON SCENERY

1. Campus of the University of Washington near Seattle; the Mines Laboratory Building is in the background.
2. Mt. Seattle, located in a favorite camping region.
3. Harvesting wheat with modern machinery near Walla Walla.

WASHINGTON



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OLYMPIA AND SEATTLE, WASHINGTON

1. State Capitol at Olympia.
2. Smith Cove Terminal, with two of the largest piers in the world, at the port of Seattle.
3. Air view of the city of Seattle.
4. Air view of the entrance to the Lake Washington Locks and Canal, connecting Puget Sound with the fresh-water harbor, Lake Washington.

extends the Mall, a magnificent parkway providing space for the Botanical Gardens, the new National Museum, Smithsonian Institution, Department of Agriculture Building, the Bureau of Engraving and Printing, the WASHINGTON MONUMENT, an obelisk of white Maryland marble 555 ft. high, begun in 1848 and completed in 1884; and the LINCOLN MEMORIAL, in line with the Capitol and the Washington Monument. This memorial, completed in 1921, is in the form of a classic Greek temple, flanked by a colonnade of Doric columns, and is made of Colorado Yule marble, Indiana limestone and Massachusetts pink granite. The most important building, the Capitol, begun in 1793, faces east at the eastern extremity of Pennsylvania Avenue. The structure is built of sandstone, measures 751 by 300 ft. and is topped by a white dome 288 ft. high. *See* CAPITOL AT WASHINGTON, THE. Second in interest is the WHITE HOUSE, or Executive Mansion, in the northwest quarter, a 2-story building of Virginia freestone, ornamented externally by a balustrade and a graceful Ionic portico; the building measures 170 by 86 ft., and is surrounded by an attractive park. Other notable structures are the Library of Congress, in Italian Renaissance style, built of New Hampshire granite; the old Treasury Building with a colonnade of 38 Ionic columns, the State, War, and Navy Building, the new structures of the Army and Navy Departments, the Senate and House office buildings, the Post-Office with a tower 300 ft. high, the Patent Office with a Doric exterior, the Pan-American building on 17th Street, the Government Printing Office, and the building of the Carnegie Institution. The dignified British Embassy on upper Massachusetts Avenue was completed in 1929. The Freer Art Gallery is designed in the Italian Renaissance style and the Corcoran Art Gallery in Neo-Grecian.

On Capitol Hill stands the Folger Shakespeare Library, the gift of Henry Clay Folger to house his collection of Shakespeareana, worth \$4,625,000. The building, designed in white marble in severely classical style, was completed in 1932. It contains some 70,000 volumes by and about Shakespeare and a theater for the production of his plays.

Following the World War, when the streets of Washington were lined with temporary structures housing multitudes of war workers, Congress appropriated \$129,405,764 for the substitution of government edifices of granite and marble and the restoration of the 2-mi. sweep of the Mall and the mile-long view of the Capitol to the Washington Monument; in other words, a reality was to be made out of L'Enfant's plan for a true national capital. For many government departments all separate offices were for the first time brought together in one structure. The new red-roofed building in Renaissance architecture of the Department of Commerce, whose offices were formerly housed in 20 different places, was completed in 1932; it forms one side of a triangle of executive buildings. This triangle, a part of which was completed in time for the Washington Bicentennial of

1932, the rest by 1937, balances the Capitol and the Mall, with the Washington Monument and Lincoln Memorial, on the other side. About the Grand Plaza of the triangle are to be grouped the new Interstate Commerce and Department of Labor buildings to cost \$11,250,000 and the Post-Office Building, costing \$10,500,000, both under construction in 1932. In another court called the Great Circle, the new Internal Revenue Building already stands. A new Department of Justice Building, costing \$12,000,000, and an Archives Building, \$8,750,000, also will be a part of the triangle. On the south side of the Mall the new Department of Agriculture Building has been erected. The classic Supreme Court and the House Office Building annex are all parts of the building program. The enterprise includes moving the Botanic Gardens across the way and replacing them with a formal garden to contain the statues of Gen. Grant, Gen. Meade and a third historical figure.

Washington is governed by a municipal commission appointed by Congress, occupying offices in a Municipal Building costing \$1,500,000.

Parks and Monuments. Besides Potomac Park and the Mall, previously mentioned, Washington has Rock Creek Park of 1,609 acres, Zoological Park, 166 acres, the 600 acres around the Soldiers' Home, and a large number of smaller recreation grounds, squares and plazas. The celebrated monuments besides the Washington Obelisk and the Lincoln Memorial are the equestrian statue of Gen. U. S. Grant in the Mall, the Du Pont Fountain in Du Pont Circle, the white marble memorial to Columbus in front of the Union Station, and the Peace Monument at the foot of Capitol Hill. The TOMB OF THE UNKNOWN SOLDIER is at Arlington National Cemetery, across the river. Scattered throughout the city are statues of Washington, Lincoln—notably the marble statue by Daniel Chester French in the Lincoln Memorial—Sheridan and other American national heroes.

Transportation. Two street railway systems provide transportation over 185 mi. within the city, and are augmented by bus lines. Rail carriers are the Pennsylvania, the Baltimore and Ohio, the Southern, the Seaboard Air Line and the Atlantic Coast Line railroads. There is steamship service to Baltimore and Norfolk.

The Francis Scott Key Memorial Bridge crosses the Potomac to connect Georgetown and Rosslyn. The new ARLINGTON MEMORIAL BRIDGE leads from the Lincoln Memorial across the Potomac to the Arlington National Cemetery in Virginia and by the Lee Highway to the Robert E. Lee mansion nearby and by the Mount Vernon Highway for 15 mi. to Washington's home. The Capitol is connected to the national airways by way of Bolling Field.

The chief manufactories of Washington are printing plants, bakeries, slaughter houses and planing mills. In 1929 the value of manufactures was about \$88,000,000; the retail trade amounted approximately to \$331,870,000. In 1930 the wholesale trade of the District of Columbia was valued at approximately

\$261,083,044. But Washington is not chiefly a manufacturing city, its business being principally the government of the United States.

History. In 1791 Maryland ceded to the Federal Government a tract of land along the Potomac, and President Washington commissioned L'Enfant to lay out the Capitol. In 1814 the British set fire to the Capitol and the White House. During the Civil War the city was frequently threatened by the Confederate armies. Improvements from 1871 onward developed for the first time the possibilities of the site on an adequate scale. In 1878 Georgetown was annexed to Washington. The period, 1921-30, saw the destruction of unsightly temporary structures erected during the World War. In 1929 Congress appropriated funds for the purchase of considerable territory lying between the White House and the Capitol, to make possible realization of L'Enfant's plan to connect the two structures with a wide parkway flanked by government buildings in the classic tradition.

BIBLIOGRAPHY.—Robert Shackleton, *The Book of Washington*, 1922; Charles A. Moore, *Washington Past and Present*, 1930.

WASHINGTON, a city in southwestern Indiana, the county seat of Daviess Co., situated near the White River, 118 mi. southeast of Indianapolis. Bus and truck lines and two railroads serve the city. The chief crops in this region are grain, soy beans and alfalfa. The city has railroad shops, packing houses and toy and coat-hanger factories. Coal and oil are found in the vicinity. Washington was founded in 1816; chartered in 1870. Pop. 1920, 8,743; 1930, 9,070.

WASHINGTON, a city in Franklin Co., eastern Missouri, situated on the Missouri River, 51 mi. west of St. Louis. Buses, river craft and the Missouri Pacific Railroad afford transportation. Grain, truck crops and apples are grown in the vicinity. The city has a creamery and bottling plant, and factories producing shoes, bone products, caps, zithers, water heaters, sausage, corn cob pipes and boxes. Washington was founded in 1839 and incorporated in 1840. Pop. 1920, 3,132; 1930, 5,918.

WASHINGTON, a port city and county seat of Beaufort Co. in eastern North Carolina, situated on the Pamlico River and Inland Waterway, 100 mi. southeast of Raleigh. A steamship line, bus lines and three railroads serve the city. The region produces tobacco, cotton, Irish potatoes, cabbage, peas and corn. Fertilizers, shirts, and canned goods are the chief local manufactures. It was the birthplace of William and Cecil de Mille and JOSEPHUS DANIELS. Washington was founded and incorporated in 1776. Pop. 1920, 6,314; 1930, 7,035.

WASHINGTON, a city of southwestern Pennsylvania, the county seat of Washington Co., situated about 25 mi. southwest of Pittsburgh. It is on the Baltimore & Ohio, the Pennsylvania, and the Waynesburg & Washington railroads. Washington is the seat of Washington and Jefferson College and Washington Seminary. It is an important manufacturing center,

with an output valued in 1929 at \$14,017,457; the retail trade was \$17,355,180. The leading products are glassware, tin plate, toys, baby carriages, and steel and clay manufactures. The city is in an extensive farming region, and has oil and gas wells and coal mines in the vicinity. Besides its public buildings, Washington also has several well-equipped libraries. It was incorporated in 1810 but did not become a city until 1924. Pop. 1920, 21,480; 1930, 24,545.

WASHINGTON, MOUNT, the highest peak in the White Mountains of New Hampshire, a part of the Appalachian system. Having an altitude of 6,293 ft., it is also the highest summit east of the Rockies and north of North Carolina. This crown of New England occurs in the Presidential Range and is noted for its scenic grandeur. Its slopes are cut by great ravines and are beautifully wooded to a height of about 3,850 ft. Dwarf evergreens extend for another 1,000 ft. above which there are comparatively level areas called lawns. Rising above these is the bare, rocky summit which gathers a heavy covering of snow during the winter. This white cap remains through the spring and early summer when the valleys below are green, but usually completely disappears before winter returns. The melting snow and mountain waters drain into the Androscoggin, Connecticut and Saco rivers.

Mount Washington may be ascended by several trails, by automobile highway, or by a cog railroad which began operating in 1869. There is a hotel on its summit from which there is a view reaching 100 mi. in all directions. The mountain was seen from the ocean as early as 1605 and was first climbed in 1642 by Darby Field. It was named in 1784 by Manasseh Cutler who led a scientific expedition to its summit.

WASHINGTON, STATE COLLEGE OF, at Pullman, Wash., a coeducational state land-grant college, founded 1892, as the Washington State Agricultural and Mechanical College. The college maintains departments of Agriculture, Mechanic Arts and Engineering, Home Economics, Veterinary Medicine, Sciences and Arts, Mines and Geology, Education, Pharmacy, Music and Fine Arts, Physical Education, Military Sciences and Tactics, the Graduate School and Experiment Stations. Its productive funds in 1931 amounted to \$1,764,370. The library contained 205,691 volumes. In 1930-31 there was a student enrollment of 4,170, and a faculty of 354, headed by Pres. Ernest O. Holland.

WASHINGTON, TREATY OF, 1871, a treaty between the United States and Great Britain, providing for the settlement by arbitration commissions of several differences between the nations: the northwest boundary (*see* SAN JUAN BOUNDARY CONTROVERSY); the northeastern fisheries; and the ALABAMA CLAIMS. The treaty was devised by a Joint High Commission, proposed by Great Britain, composed of five commissioners representing each country, which met at Washington, D.C., completing its deliberations by May 8, 1871. A permanent contribution to international law

WASHINGTON, D. C.



COURTESY U. S. ARMY AIR CORPS

THE NATION'S CAPITAL SEEN FROM THE AIR

In the upper center appears the dome of the Capitol Building and opposite it in the foreground the shaft of the Washington Monument, near the Potomac River. Back of the Capitol is the Library of Congress, to the left the Senate Office Building and to the right the House Office Building. The lines of the Mall radiate toward the River and the White House, in the lower left.

was embodied in the treaty, in the form of a definition of the obligations of neutrals, for the guidance of the projected tribunal to settle the ALABAMA CLAIMS.

WASHINGTON, UNIVERSITY OF, at Seattle, Wash., a coeducational state institution, was founded in 1861 on a 10-acre tract in what has since become the business district of Seattle. It comprises colleges and schools of Liberal Arts, Science, Business Administration, Education, Engineering, Fine Arts, Fisheries, Forestry, Journalism, Law, Library Science, Mines and Pharmacy, the Graduate School and Extension Service. An engineering experiment station, the Bailey and Babette Gatzert Foundation for Child Welfare, the McDermott Foundation for Medical Research and the Puget Sound Biological Station in the San Juan Islands are all parts of the university. Noteworthy among the collections are the Emmons Alaska Indian, the Esquimaux, the Philippine Ethnological Collections, and the H. C. Henry Gallery of Art. The institution received an appropriation for the biennium 1931-33 of \$5,751,000. The library of 273,335 volumes contains the Pacific Northwest History Collection. In 1931-32 there was a student enrollment of 6,924 and a faculty of 456, headed by Pres. Matthew Lyle Spencer.

WASHINGTON AND JEFFERSON COLLEGE, at Washington, Pa., an institution for men, was formed by a union of Jefferson College, chartered in 1802, and Washington College, chartered four years later. The united college was chartered in 1865. The initial organization, from which the later institutions developed, was Washington Academy, founded in 1787. Washington and Jefferson had productive funds in 1931 amounting to \$1,484,952. The library contained 44,246 volumes. In 1931-32 there were 434 students, and a faculty of 34, headed by Pres. Simon S. Baker.

WASHINGTON AND LEE UNIVERSITY at Lexington, Va., a privately controlled and non-sectarian institution for men, founded in 1749. Incorporated as Liberty Hall Academy in 1782, the institution changed its name to Washington Academy in 1798, following a gift of \$50,000 from George Washington. In 1804 it moved to its present site. It became Washington College in 1813, and Washington and Lee University in 1871, one year after the death of Gen. ROBERT E. LEE, for five years president of Washington College. The university had productive funds in 1931 amounting to \$1,489,536. The library of 70,000 volumes contains four collections of material relating to the Civil War and Southern History. In 1931-32 there were 862 students, and a faculty of 58, headed by Pres. FRANCIS P. GAINES.

WASHINGTON ARCH, a structure of white marble situated at the foot of Fifth Avenue, New York, and forming the entrance to Washington Square. It was completed in 1893 at a cost of \$250,000, raised by popular subscription. The dedication ceremonies took place May 1, 1889, the centenary of Washington's inauguration. The design

is by Stanford White and the dimensions are: height, 86 ft.; span, 30 ft.; piers, each 10 ft. wide. The arch carries an inscription from the inaugural address, and on piers of the Fifth Avenue side are two figures of Washington in high relief, one in civilian dress and the other in military uniform.

WASHINGTON CONFERENCE, officially "Washington Conference on Limitation of Armaments and on Far Eastern and Pacific Questions," meeting at Washington, D.C., Nov. 12, 1921-Feb. 6, 1922. The movement for an international conference initiated by Sen. William E. Borah and furthered by the Department of State resulted in the formal invitation extended by President Harding, Aug. 11, 1921, to the British Empire, Japan, France, Italy, China, Belgium, the Netherlands and Portugal. The proceedings were outlined in advance: limitation of naval armament; control of new agencies of warfare; limitation of land armament; questions relating to China; mandated islands and electrical (cable and radio) communications in the Pacific. The delegation of the United States comprised Charles Evans Hughes, Secretary of State; Henry Cabot Lodge; Elihu Root; Oscar Underwood. Among the 27 other delegates were A. J. Balfour, Sir Auckland Geddes, Great Britain; Sir Robert Borden, Canada; Aristide Briand, Jules Jusserand, René Viviani, France; Carlo Schanzer, Luigi Albertini, Italy; Tomasaburo Kato, Japan. Aside from the delegations proper were numerous bodies of technical experts and advisers from the several countries. The British attendance included a skilled staff of publicists which throughout the conference secured excellent representation of the British views in the American press.

Hughes, chairman of the conference, presented a thoroughgoing program for the cessation of naval construction for 10 years and for the scrapping of 68 capital ships by the United States, Great Britain and Japan. The French delegation showed little disposition to cooperate toward the ends of the conference, although the proposed schedules gave France a notable relative gain in naval strength; Italy's attitude was found contingent upon that of France. After considerable discussion, Briand withdrew from the conference, Nov. 21. Meanwhile China presented the principles which should determine Far Eastern policy. On Nov. 30 China and Japan accepted the mediation of the United States and Great Britain in the Shantung dispute. (*See SHANTUNG AGREEMENT.*) Within the next fortnight the United States and Japan agreed upon privileges in Yap and other mandated islands (*see YAP CONTROVERSY*); and the conference returned to the reduction of armament. Limitation of land armament was found an impracticable topic. A program of naval limitation was agreed upon (*see FIVE-POWER NAVAL TREATY*), considerably modifying Hughes's original proposals. The *NINE-POWER TREATY* stated principles of Far Eastern policy, tending to protect the integrity of China; the *FOUR-POWER TREATY* terminated the Anglo-Japanese Alliance of 1911 in favor of a broader basis of peace in the Pacific insular

area. The greatest work of the conference was in the formal commitments of the several nations to harmonious relations, and in upbuilding a popular tendency toward the "moral outlawry" of war.

BIBLIOGRAPHY.—R. L. Buell, *The Washington Conference*, 1922; C. C. Morrison, *The Outlawry of War*, 1927; N. M. Butler, *The Path to Peace*, 1930.

WASHINGTON COURT HOUSE, a city in southwestern Ohio, the county seat of Fayette Co., situated on Paint Creek, 35 mi. southeast of Springfield and served by two railroads. Farming and stock-raising are engaged in throughout the district. The local industries include shoe, flour and fertilizer manufacture, machine shop work and canning. Washington Court House was platted in 1810 and chartered in 1888. Points of interest, such as Bryan State Park, Seven Caves, Pike County Forest and Kincaid Spring are easily reached from Washington Court House. Pop. 1920, 7,962; 1930, 8,426.

WASHINGTON CROSSING PARK, a park in Mercer Co., N.J., 6 mi. northwest of Trenton. The park, containing 237 acres, was established in 1923. It marks the site where Washington and the Continental Army crossed the Delaware River in a snow and sleet storm and surprised the Hessians in Trenton on Christmas night.

WASHINGTON HEIGHTS, the northern part of Manhattan Island, New York City. Washington Heights occupies the hilly land between 135th Street and Spuyten Duyvil Creek. Among the places of historic interest on the Heights are The King's Bridge, Ft. Clinton, Ft. George, Ft. Washington, Hamilton's Grange, City College and Inwood Park. Washington Heights was the scene of military activity during the American Revolution and Ft. WASHINGTON was taken by the British on Nov. 16, 1776.

WASHINGTON INCIDENT, THE, a controversy between the United States and Canada, over the seizure and condemnation of the American ship *Washington* in 1843. The seizure occurred in the Bay of Fundy, 10 miles off-shore. The British allegation was that under the CONVENTION OF 1818 all bays not specifically included in the treaty were closed to American vessels. Popular resentment was high in New England. Secretary of State Everett and Lord Aberdeen engaged in protracted correspondence, in which both nations threatened the intervention of a fleet. An American naval force was in fact dispatched to the fisheries. In Mar. 1845 Lord Aberdeen advised Everett that American vessels would be allowed to sail and fish in the Bay of Fundy unmolested, as an act of grace, although the United States had no legal right to the privilege. This settlement was accepted.

WASHINGTON MONUMENT, of Washington Park, Washington, D.C., is a 555-ft. high tapering obelisk erected in memory of George Washington. There was a Congressional resolution proposed in 1799 for an equestrian statue of Washington, but it was not until an association headed by Chief Justice Marshall was formed that a large building fund was raised. The cornerstone was laid July 4, 1848, and

building continued until the shaft had risen 150 ft. At this point funds ran out. In 1878, Congress provided for the completion of the shaft.

The foundation of solid blue rock is 146 ft. square. The base of the shaft is 55 ft. square and the lower walls are 15 ft. thick, becoming 18 in. thick at the top and 35 ft. square. The first 150 ft. of the interior is lined with blue granite and the remaining distance is finished with regular courses of granite. In 1884 the cap stone, 5 ft. in height and tipped with aluminum, was set. Elevators and a staircase of 900 steps provide ascent to the top. Along the walls are 177 memorial stones from states, cities and societies. Building costs were estimated at \$1,187,710.

WASHINGTON PALM, a peculiar genus (*Washingtonia*) of the PALM family consisting of three species growing about the Gulf of California. One of these, *Washingtonia filifera*, the Washington palm, is found in the state of California. It is a tree with a columnar unbranched trunk 20 to 75 ft. high and 1 to 3 ft. in diameter, crowned with a tuft of living fan-like leaves and covered from top to bottom with a thatch of dead recurved persistent leaves unless these have been removed by fire or man. At one time in recent geological ages the Colorado Desert in southeastern California was filled by an arm of the sea. Around its shores grew this palm which has persisted at scattered stations to the present day along the old beach line or by springs or rivulets somewhat above it. For food, fiber and huts the tree was of economic importance to the Indian tribes of the region. It is more widely planted in California than any other palm. W. L. J.

WASHINGTON UNIVERSITY at St. Louis, Mo., a coeducational, non-sectarian, and privately controlled institution founded in 1853 as Eliot Seminary. In 1857 the name was changed to Washington University. The university is composed of 13 divisions: College of Liberal Arts; schools of Engineering, Architecture, Business and Public Administration, Botany, Graduate Studies; Law; Medicine, Dentistry, Nursing, Fine Arts; Division of University Extension; and Summer School. It had endowment funds in 1931 amounting to \$18,697,120. The library of 318,408 volumes contains among its notable collections the Preetorius Memorial on German Language and Literature and the W. K. Bixby collection of rare books. In 1931-32 there was a student enrollment of 7,355, and a faculty of 656, headed by Chancellor GEORGE REEVES THROOP.

WASHO, a North American Indian tribe forming a distinct linguistic family. When first encountered they lived on the Truckee River in Nevada and also occupied the Carson River up to a point below Carson City, the shores of Lake Tahoe, and the Sierra valleys up to Honey Lake, Calif. They lived in the mountains only in summer. They were conquered about 1850 by the Paiute. Now they eke out a meager existence, depending on the towns and ranches.

WASP, a name commonly applied to those members of the insect order *Hymenoptera* of which the

females possess a sting, excluding, however, bees and ants. Wasps are a highly diversified and abundant group of insects, with many thousands of species. They occur in all regions of the world, but are more abundant and diversified in warm and tropical regions. They are divided into two major groups, the *Vespoidea* and the *Sphecoidea*. Each of these consists of several families.

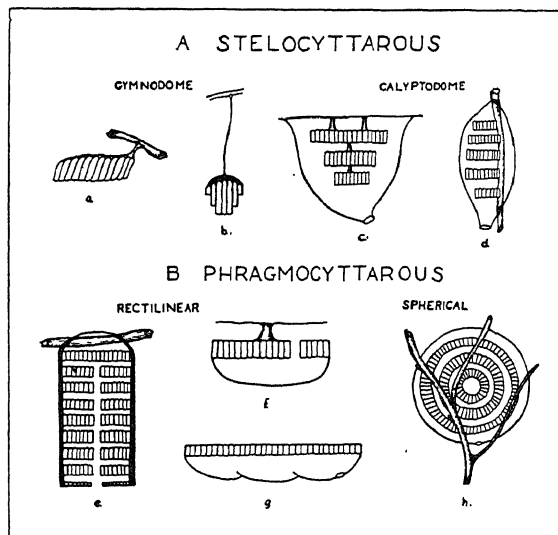
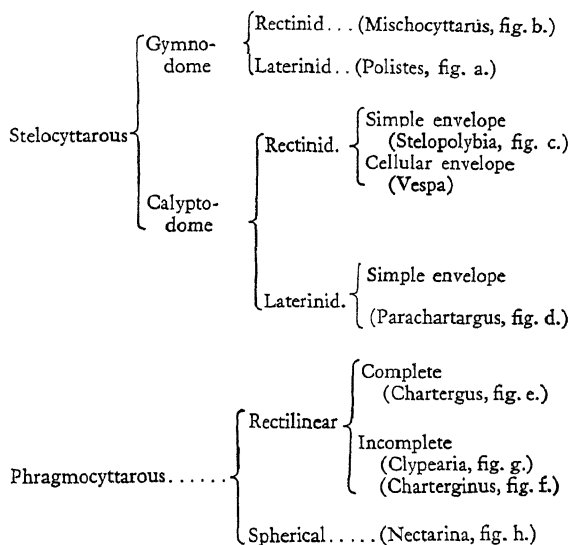
Evolution. The larvae of the primitive *Hymenoptera* are caterpillar-like. The adult female possesses a saw-like ovipositor with which she tears a slit in plant tissues for reception of her eggs. In lieu of these habits the parasitoid *Hymenoptera* have substituted a passive larval life as parasites. Their larvae, bathed in nutritive fluid, have no need for locomotion, and have become legless, blind, white grubs. The ovipositor has been transformed from a saw to a piercing needle, capable of inserting an egg in the body of a caterpillar. The larvae of wasps are like these parasitoids in habits and structure. The ovipositor of the adults no longer used for laying eggs has become a short sting or hollow tube through which poison is injected into the host larva. This poison throws the latter into a coma which usually lasts for an extended period and provides a constantly fresh food supply for the wasp-larva. The wasp can thus control the host-larva instead of leaving it to continue its normal exposed life. These conditions were prerequisite to the development of a domicile, a stored food-supply, and a sense of property-right.

At first a crack or cranny afforded a crude nest. The next stage is shown by wasps (*Scoliidae*) which

those which first dig the burrow, then go in search of provender with which to store it. Very many kinds of wasps dig nests in soil, or use hollow stems of plants, or burrow into wood. But it is another upward step when they become craftsmen, and build elaborate nests of some suitable medium, first clay or mud, then paper. Another significant change is in connection with the feeding habits. The mother wasp is at first content to seal up her egg with the food she has provided for the larva and never to see it again. Sand wasps (*Bembicinae*) bring fresh food to the larva as it grows, carefully closing the nest whenever they leave it. Finally there has developed cooperation between females in building nests and raising the brood, and this has led to the complex colonies of the social wasps (see SOCIAL INSECTS).

Architecture. The nests of social wasps consist of one or more layers of closely adjoining cells, each layer forming a "comb" as in honey-bees. Both comb and cover, when present are of the same substance, usually paper or carton, rarely clay. The substance may be a delicate friable tissue, a tough paper, or a very tough and thick carton. The architectural plan of the nest is definitive of the kind of wasp.

ARCHITECTURAL PLANS OF NESTS OF SOCIAL WASPS



ARCHITECTURE OF THE NESTS OF SOCIAL WASPS

a, *Polistes* (laterinid); b, *Mischocyttarus* (rectinid); c, *Stelopolybia* (rectinid); d, *Parachartargus* (laterinid).
e, *Chartergus* (complete); f, *Charterginus* (incomplete); g, *Clypearia* (incomplete); h, *Nectarina*.

find an underground larva, paralyze it and are content merely to dig a crude cell around it. More advanced wasps find their prey and dig a burrow to house it. Still higher in the evolutionary scale are

In *stelocytтарous* nests the comb is attached to a support by one or more pedicels and is entirely without an envelope (gymnodome) or contained in but free from the envelope (calyptodome). If the combs are disc-shaped, built out equally in all directions from a central stalk, the nest is *rectinid*; if wedge-shaped, with the stalk at the apex, it is *laterinid*. In the latter types the envelope is added after the comb is built, and the nest cannot be enlarged. In *phragmocytтарous* nests the envelope is attached to the side of the comb. If the comb is flat, the nest is *rectilinear*. In the incomplete type there are only one or two stories, and there is no common passageway into successive chambers. Nests such as those

of *Clypearia*, are increased laterally. In the complete types new combs are built on the under side of the envelope, closed in and a new story thus added. All stories are connected by a common passageway. Such a nest is capable of indefinite growth in a linear direction, and the material must be strong. Finally, in the spherical type, the comb is rolled up into a ball, and new combs added to the outside, so that the nest increases equally in all directions. J. C. B.

BIBLIOGRAPHY.—George W. and Elizabeth G. Peckham, *Wasps Social and Solitary*, with an introduction by John Burroughs, 1905; Edward G. Reinhard, *The Witchery of Wasps*, 1929.

WASP, PEPSIS, a large wasp of the genus *Pepsis*, native to the Southwest. These are giants of the spider-wasp family (*Pompilidae*), commonly known as tarantula hawks because they store tarantulas in their burrows as food for the larvæ. If successful in her attack, the female wasp stings and paralyzes a tarantula, dragging it to her burrow alive but helpless. If unsuccessful, she is herself killed and eaten.

WASP and FROLIC, two warships which engaged in a combat Oct. 18, 1812, resulting in an American naval victory in the WAR of 1812. The American sloop of war *Wasp*, with 18 guns and 135 men, under command of Capt. Jacob Jones, sailing from the Delaware toward the West Indies, encountered a fleet of armed merchant vessels protected by the British sloop *Frolic*, with 20 guns and 108 men, under command of Capt. Whinyates. The *Wasp* early lost its main-topmast, and the main yard, falling, fouled the head yards; in 20 minutes every brace and most of the rigging were disabled. Meanwhile the hull of the *Frolic* was seriously damaged. In the heavy sea the combatants ran foul of each other. The American crew succeeded in boarding the British vessel. Every officer on the *Frolic* was wounded, and all but 20 of the crew were killed or injured. The *Wasp* lost five men killed and five injured. Almost immediately after this engagement the British ship of war *Poictiers*, with 74 guns, under command of Capt. Beresford, arrived. Not desiring to chance an engagement, the *Wasp* surrendered.

WASSERMANN, JACOB (1873-), German novelist, was born Mar. 10, 1873, in Furth, Bavaria. He is considered one of the most significant of modern German novelists. He learned much from DOSTOEVSKI and is a master of psychological analysis. The lyric note in his novels issues from a sympathetic, nervous temperament. Among Wassermann's outstanding novels are *Die Juden Von Zirndorf*, 1897, *Caspar Hauser*, 1908, *Das Gänse-Männchen*, 1915, translated into English as *The Goose-Man*, 1922, *Der Aufruhr*, 1926, *Der Fall Marizius*, 1928, and *The World's Illusion*.

WASSERMANN REACTION. See VENEREAL DISEASE.

WASTE ELIMINATION. Waste in industry is the difference between what is and what should be. But waste is of two kinds: (1) unpreventable waste, based on present standards and (2) preventable waste.

The movement known as the "waste elimination movement" is concerned with preventable waste, which runs into the billions of dollars in industry annually. Preventable waste falls into two great groups: (1) material waste (furnace slag and wood turnings as examples), (2) human waste (time and energy of people in doing things).

In the elimination of waste the work has divided itself into: (A) salvaging to eliminate waste in materials, (B) campaigns to induce humans to become more efficient thereby reducing the waste of energy and time.

The field ahead of the salvaging movement is still an enormous one. A salvage questionnaire of The Society of Industrial Engineers, covering 106 industries, showed that one-fourth of the firms listed at over \$1,000,000 have no salvage departments; that only half of the concerns listed at from \$500,000 to \$1,000,000 have them; and that a little over a third of those listed under \$500,000 have such departments.

In the larger field of elimination of human waste, relatively few firms have accomplished anything like the results possible, and these are the larger firms, such as Westinghouse Electric & Manufacturing Company, Goodyear Tire & Rubber Company, Newport News Shipbuilding Company and U.S. Steel Corporation.

One of the results of the "Waste in Industry" report by the Committee on the Eliminating of Waste in Industry (1921) under the direction of Herbert Hoover was the organization of the Division of Simplified Practice of the U.S. Department of Commerce. Millions of dollars have been saved yearly to American industry through the work of this division. The possibilities in this field are savings of from \$200,000,000 to \$500,000,000 yearly.

Our annual waste bill in the field of distribution is estimated at between 8 and 10 billion dollars. The American Society of Mechanical Engineers has a committee on waste elimination, which is doing a worthwhile work in showing industrial concerns how to organize to eliminate the preventable waste.

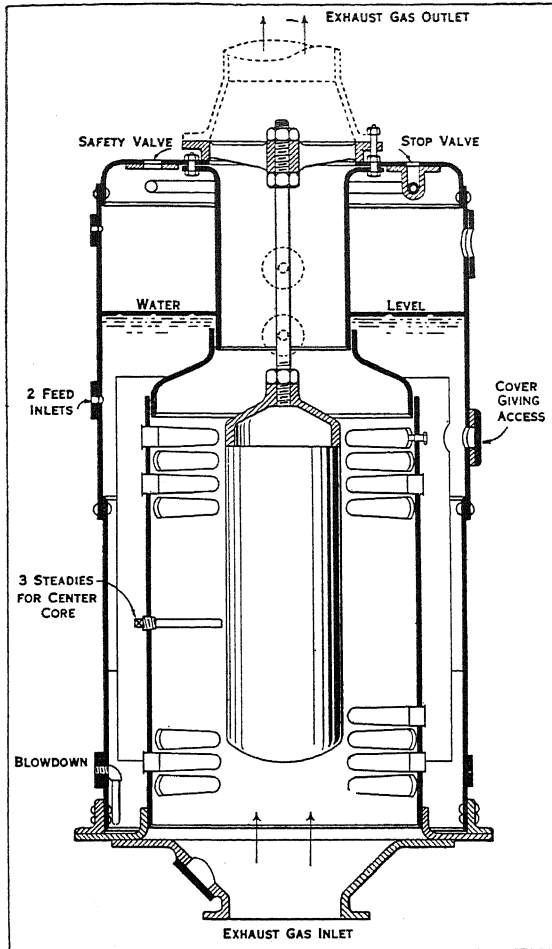
To those who have given thought to this matter of waste elimination it is the conviction that the profits of to-morrow are coming out of the wastes of to-day; that far-sighted executives are aware of this fact and are governing themselves accordingly; and that the greatest progress of the movement in the future will be made in the field which is known as distribution.

C. E. K.

BIBLIOGRAPHY.—Harrington Emerson, *Efficiency*; American Society of Mechanical Engineers' publication, *Waste in Industry*.

WASTE-HEAT BOILERS operate upon the heat of gases discharged from the chimneys of furnaces or kilns or from the exhausts of INTERNAL COMBUSTION ENGINES. These BOILERS may be either of the fire-tube or water-tube type. For large installations, the water-tube boiler predominates by reason of the safety and cost features. However, as most of the heat must be recovered by convection, the narrow passages of the

fire tubes make the fire-tube boiler more efficient. But if pressure of any magnitude is to be carried, the necessarily thick shell of this design makes its use impossible.



COURTESY "POWER"

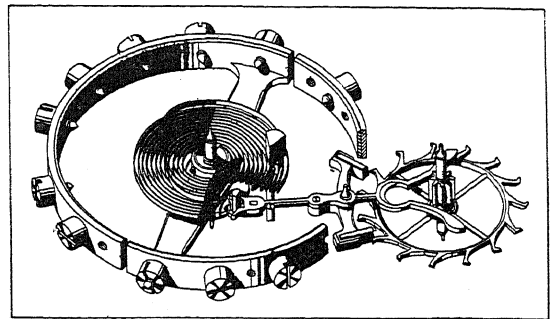
WASTE HEAT BOILER UTILIZING THE HEAT IN EXHAUST GASES OF AN INTERNAL COMBUSTION ENGINE

The accompanying figure shows a boiler which utilizes the heat in the exhaust gases of internal combustion engines. It develops about one pound of steam per engine horsepower. L. H. Mo.

WATAUGA ARTICLES, the first compact of government west of the Alleghenies, devised and adopted in 1772 by a group of settlers on the Watauga River, a source of the Tennessee. These settlers, geographically isolated, established the Watauga Association, to be governed by the articles adopted in general assembly. The articles are lost, but their general content is known. A committee of 13, acting as a legislative body, appointed a council of five from their own number to administer the legislative and judicial powers. Although the Watauga Association was virtually an independent colony for four years, the influx of outlaws and renegades from Virginia and North Carolina made the preservation of

order impossible. In 1776, on petition, the district was received under the jurisdiction of the state of North Carolina.

WATCHES, timepieces which are most appropriately defined as portable Clocks. The watch, like the clock, comprises a source of power, a train of gears, an escapement, an oscillating mechanism for uniformly regulating the movement, hands and a dial. A coiled spring, the main spring, connected to the first wheel of the train propels the mechanism. That spring is compactly coiled, or "wound," by means of a stem extending through the case of the watch, and is held from unwinding by a RATCHET AND PALL. The escapement comprises a "hooked"-toothed wheel, the last wheel of the train, and a device for catching and releasing the teeth to permit the wheel to rotate



COURTESY ELGIN WATCH CO.

BALANCE WHEEL, HAIR SPRING AND ESCAPEMENT OF MODERN WATCH

through equal distances at regular intervals. The catching and releasing mechanism is operated by an oscillating wheel, the "balance wheel," connected to a coiled "hair spring." When the "catch" releases the wheel it is given an impulse by the passing tooth. This impulse is transmitted to the balance wheel to keep it oscillating. The hands of the watch are driven by wheels connected through a shaft to the second wheel of the train. These wheels are also connected to the stem to provide for "setting" the watch.

Watches date from the early 16th century, when they were invented by a Nuremberg clockmaker, Peter Henlein. The first watches were expensive, large, clumsy and inaccurate. They were valued chiefly for their highly ornamented cases and novel designs. The invention of the coiled hair spring and its application to the balance wheel in 1658 was the first important improvement. Other improvements in the 18th century brought the watch to its modern form. The most important of these were the compensated balance wheel, duplex escapement and thin case. Machinery was first used in watch making in Boston, in 1853. The most recent notable improvement in watches is the development of a hair spring which is not affected by temperature changes or magnetism.

WATER, a clear, colorless liquid, possessing neither odor nor taste. It is the most universally distributed of compound substances, and is essential to the existence of life on this globe. It occurs abundantly both

free and in combination, and all living matter, including the human body, is about seven-eighths water.

Nearly three-fourths of the earth's surface, over 143,000,000 sq. mi., is occupied by the oceans, which contain more than 323,000,000 cu. mi. of water. Were the earth a smooth surface, with no protuberant continents, these waters would cover it to a depth of about two miles. Water is a universal solvent, and traces of every known element are found in sea water. Approximately 34 parts by weight of mineral matter are dissolved in every 1,000 parts of ocean water, chiefly common salt (sodium chloride) together with lesser quantities of magnesium chloride, sulphate and bromide, calcium carbonate and sulphate, and potassium sulphate. The gases oxygen, nitrogen, and carbon dioxide are also extensively dissolved. The amount of matter in solution in sea water varies slightly from place to place, according to temperature, evaporation, currents, and local supplies of fresh river water.

Rivers carry about 6,500 cu. mi. of water to the seas yearly. This water contains much less dissolved matter, the actual material depending on the nature of the rocks and soils traversed by the running water. The rivers also carry immense amounts of solid matter in suspension, to be dropped where they flow into lakes or seas (*see* SEDIMENTATION). The high mineral content of ocean water is due to the concentration by evaporation, throughout geological ages, or the river water of low mineral content continually poured into the ocean basins.

Among the substances carried by river water in settled regions, must be listed the organic contaminations resulting from sewage and industrial plants. Except in regions containing natural salt formations, the presence of chlorides, of much ammonia and of nitrogenous matter, indicates organic contamination. However, polluted water may become potable at some distance from the source of pollution, since organic material is usually oxidized in running water, forming nitric and nitrous acids.

Rivers receive their supply from water precipitated from the atmosphere. Part of this may run off the surface directly into streams, while the remainder seeps into the ground to join the "ground water," or water underground. Some of this latter eventually reaches the rivers, and some forms springs. There are also springs which derive their water from the exhalation of cooling magmas in the dying stages of vulcanism. These are likely to contain various minerals in solution, and are sometimes of use medicinally, when they are called medicinal springs, and mineral waters.

The amount of ground water in existence is probably enough to make a sheet of water more than 1,000 feet thick over the whole earth; some authorities have placed the figure as high as 3,000 ft. Much water for domestic uses, especially in rural regions, comes from wells put down to the WATER TABLE, or level of ground water. Hence the question of contamination, as in rivers, is important. In regions containing limestone and dolomite formations both ground

water and river water dissolve calcium and magnesium bicarbonates and sulphates. These impart a distinctive taste to the water, and also make it difficult for soap to lather. Such waters are called "hard water." Their use in boilers is deleterious because the dissolved salts are precipitated in the boiler tubes, forming scale.

The purest natural water is that freshly precipitated as rain, dew, snow and hoar frost. Impurities in rain water, chiefly ammoniacal and inorganic salts, and organic material taken up from the atmosphere, range in amount from only 2 to as high as 42 parts in 100,000. Near the sea, salt may be present. Precipitated water comes from water vapor in the atmosphere, which, in turn, has been evaporated from the sea by the sun's rays. There is thus a never-ending cycle of evaporation, precipitation, and return to the sea. New supplies of water are also discharged into the atmosphere by volcanic action.

Chemically, water (H_2O) consists of two volumes of hydrogen combined with one of oxygen. By weight, it is two parts of hydrogen and 16 of oxygen. The union of these two gases at high temperature produces water, and so also does the neutralization of a base by an acid. When dissolved in water, most salts ionize, or break up into positively and negatively charged units. This facilitates recombinations, so water usually promotes chemical reactions, and is essential for many.

Water, when pure, is one of the poorest conductors of electricity; it is also a poor conductor of heat. Bodies of water lose and gain heat more slowly than do land masses. Consequently, the oceans and the water vapor in the atmosphere minimize temperature changes at the earth's surface and thus profoundly influence climate. Small quantities of pure water are colorless, but considerable thicknesses appear greenish-blue by transmitted light. Water is nearly incompressible, a given volume being reduced by only 50 parts in a million as a result of doubling the pressure upon it. Under atmospheric pressure at sea level, water boils at $212^{\circ} F.$ or $100^{\circ} C.$ and freezes at $32^{\circ} F.$ or $0^{\circ} C.$ Lowering the pressure lowers the boiling point and raises the freezing point, the former being especially noticeable at high elevations, under reduced atmospheric pressure. The maximum density of water is at $39.2^{\circ} F.$ or $4^{\circ} C.$, when one cubic centimeter weighs one gram. This is taken as the standard of density. When freezing, or passing to the solid, crystalline state, Ice , it expands by one-eleventh, as a result of which ice floats in water. The passage to steam or vapor, involves an expansion to 1,700 times the volume of the original water. Heat transfers accompany these changes, 79 calories per gram being evolved when ice forms and absorbed when it melts. The passage to steam at $100^{\circ} C.$ absorbs 536 calories per gram. Thus, ice is colder than water at the same temperature, and steam hotter than water at the same temperature. A calory, the standard unit of heat, is defined as that amount of heat needed to raise one gram of water from 18° to $19^{\circ} C.$

WATER COLOR PAINTING



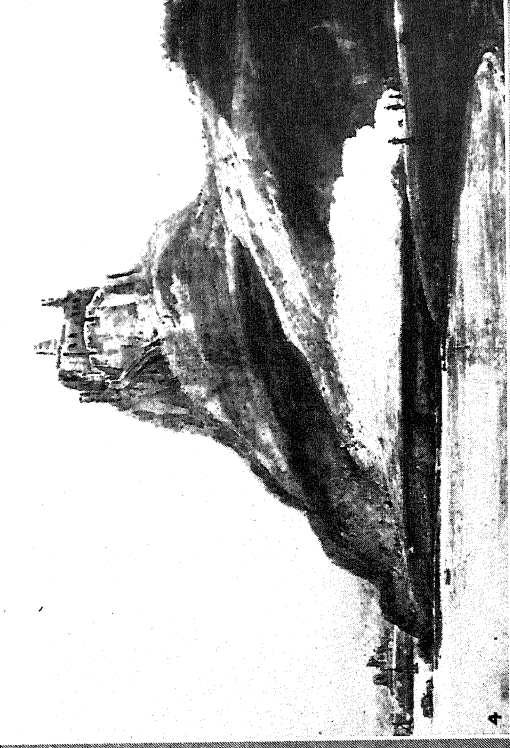
COURTESY METROPOLITAN MUSEUM OF ART

ENGLISH AND FRENCH WATER COLOR PAINTING OF THE NINETEENTH CENTURY

1. "She Shall Be Called Woman," by William Blake (1757-1827). 2. "Baigneuses," by Puvis de Chavannes

(1824-98). 3. "L'Amateur," by Honoré Daumier (1808-79). 4. "Paysage," by Camille Pissarro (1830-1903).

WATER COLOR PAINTING



ENGLISH AND FRENCH WATER COLOR PAINTING

1. "Elijah in the Fiery Chariot," engraving tinted with water colors, by William Blake (1757-1827).
2. "Hérons in Landscape," by Antoine Louis Barye (1795-1875).
3. "Bear Killing a Bull," by Antoine Louis Barye.
4. "St. Michael's Mount," by Thomas Girtton (1775-1802).

WATER COLOR PAINTING

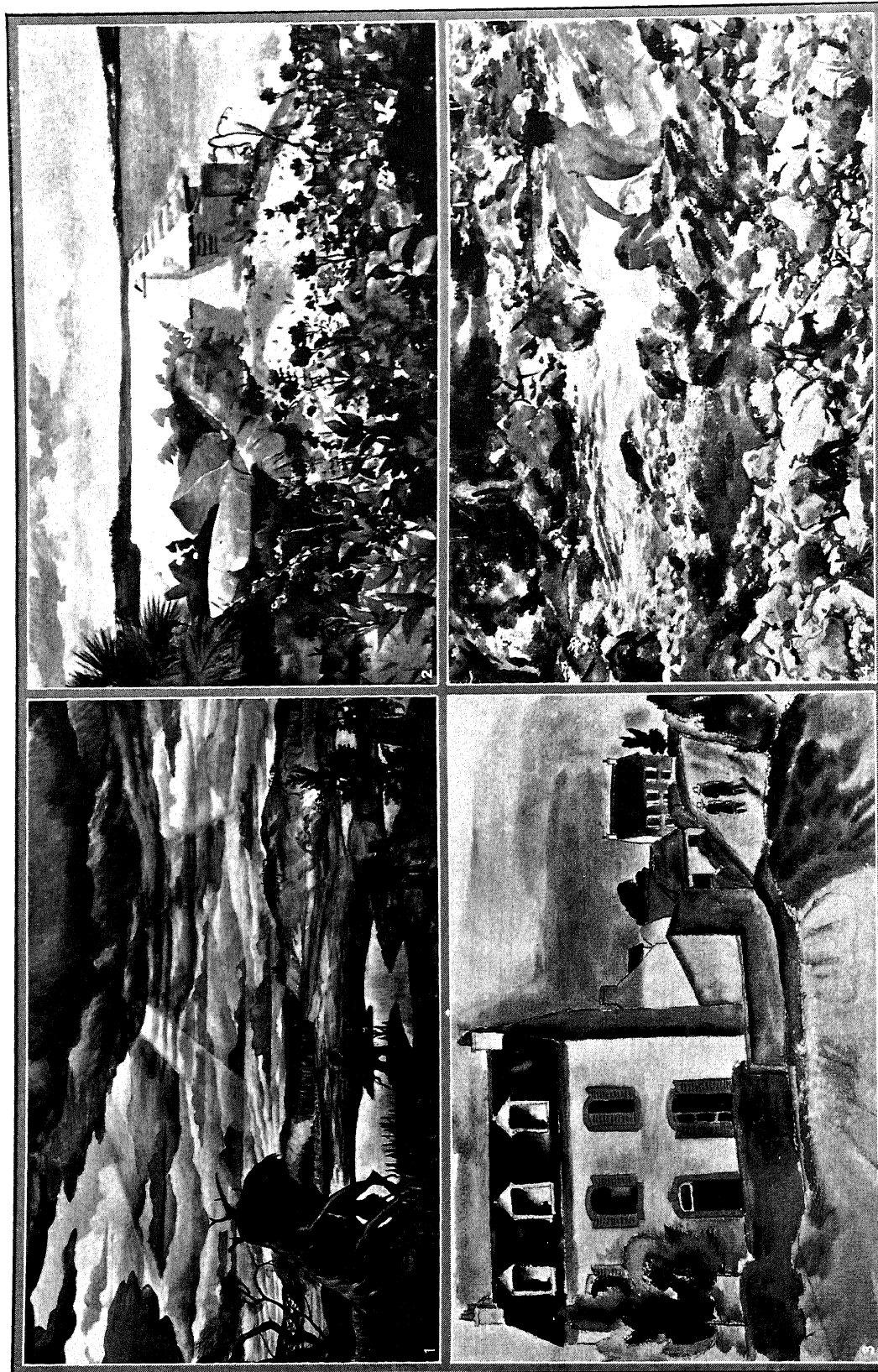


1. COURTESY PETER A. JULEY; 2. MUSEUM OF FINE ARTS, BOSTON; 3. DOWNTOWN GALLERY, NEW YORK

WATER COLOR PAINTINGS BY AMERICAN ARTISTS

1. "Red and Yellow Gladioli," by Charles Demuth (1883-). 2. "Samoan Landscape," by John La Farge (1835-1910), one of a series of pictures made during a visit to the South Seas in 1886. 3. "Poppies," by Charles Demuth (1883-).

WATER COLOR PAINTING

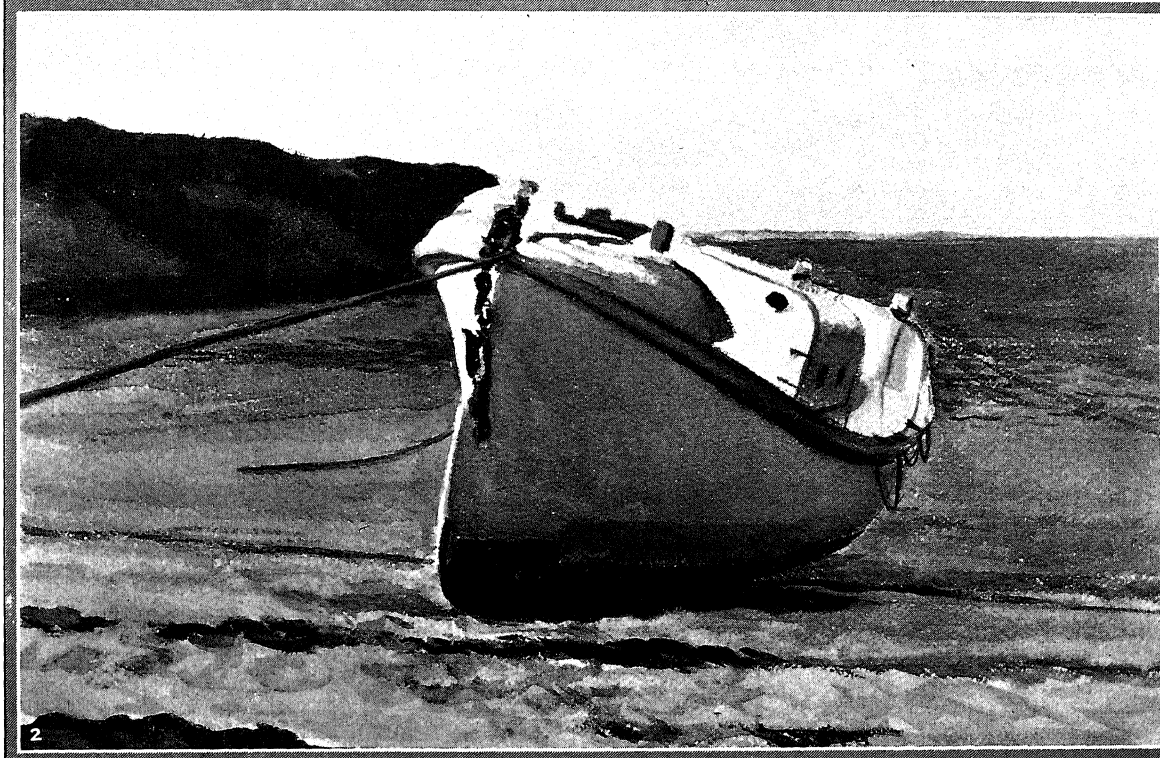


1. 3. COURTESY FRANK K. M. REHN GALLERY, NEW YORK CITY; 2. 4. METROPOLITAN MUSEUM OF ART

AMERICAN WATER COLOR PAINTING

1. "March," Charles Burchfield (1893-).
2. "Flower Garden and Bungalow," by Winslow Homer (1836-1910).
3. "South France," by Ernest Fiene (1894-).
4. "Mountain Stream," by John Singer Sargent (1856-1925).

WATER COLOR PAINTING



COURTESY FRANK K. M. REHN GALLERY, NEW YORK CITY

CONTEMPORARY AMERICAN WATER COLOR PAINTING

1. "Winter," by Charles Burchfield (1893-).
2. "Life Boat," by Edward Hopper (1882-).

In the form of vapor, water is an invisible gas, the white color of "steam" being due to minute particles of condensed water. The vapor can exist only below a certain pressure at any given temperature. Raising the pressure or lowering the temperature produces liquefaction. By these processes, water vapor in the atmosphere is precipitated as rain, snow, dew, or frost. Above 687° F. or 364° C., the "critical temperature," water is vapor at any pressure, the state in which it probably exists within the earth's heated interior. Great quantities are also locked up in chemical combination in many of the rock-forming minerals.

Water is the most important single agent in forming the face of the earth. It facilitates the WEATHERING of rocks into soil, and the erosion of the land into hills and valleys. New rocks are formed of the deposits laid down by water in the processes of sedimentation. It is one of the four great natural resources, soil, forests, waters, and minerals, and without water, neither soil nor forests can exist. Nor can life survive without water, so that the distribution of plants and animals depends on the distribution of rain and rivers. In fact, life on the earth is supposed to have had its inception in some body of water. Man must bring water in to irrigate the arid regions in order to inhabit them. Water power is being increasingly used to generate electromotive power for industry, and aside from this, hardly any industrial process can go on without using water at some stage. The problem of water supply for large cities is pressing, and necessitates huge engineering works to impound great quantities. Because of man's inability to dispense with it, and its value as a source of power, water may be considered the most valuable of all "mineral" resources. Its ultimate derivation is the ocean, whence it is made available solely by the sun's action. S. F. K.

BIBLIOGRAPHY.—G. C. Whipple, *Microscopy of Drinking Water*, 1914; A. Hazen, *Clean Water and How to Get It*, 1914; O. E. Meinzer, *The Occurrence of Ground Water in the United States, with a Discussion of Principles*, U.S. Geol. Survey, Water-Supply Paper 489, 1923, and other papers of the Water-Supply series; F. E. Turneure and H. L. Russell, *Public Water Supplies*, 1924.

WATER, ARTESIAN. See ARTESIAN WELLS.

WATER, UNDERGROUND, called also "Sub-surface Water," includes all the water below the surface of the solid earth. Part of the moisture falling on the ground runs off into streams, but part percolates downward through the interstices in soil and rocks. Some of this is held against the force of gravity by capillary attraction, and is known as "Vadose Water." Although it may appreciably moisten the formation containing it, and supply plants with their moisture requirements, it will not flow into wells. The excess over what can be retained thus sinks to the WATER TABLE, the upper limit of the zone in which the rocks or soils are saturated. Here the water is present in too great a quantity to be held by capillarity, and is under the control of gravity. It will therefore flow into wells which penetrate the water table. In regions of soluble rocks, such as LIMESTONE, it may

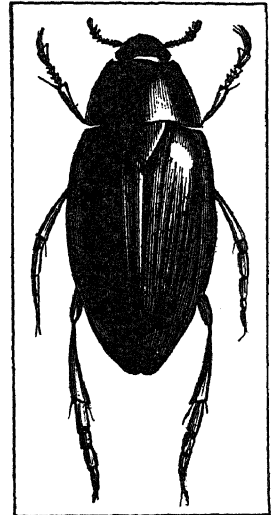
dissolve extensive underground channels for itself, and produce such formations as the Mammoth Caves of Kentucky and the Carlsbad Caverns of New Mexico.

Ground water in IGNEOUS or METAMORPHIC ROCKS is usually within 300 feet of the surface, but in more porous formations, such as SANDSTONE, it may be encountered at 2,000 feet, or deeper. At great depths, pressure closes the interstices which usually hold water.

Water held in deep lying strata by an overlying bed of impermeable material such as SHALE, may sometimes be under sufficient pressure to cause it to spout up through wells or drill-holes which penetrate the "Aquifer," or water bearing formation. This is "Artesian Water." Occasionally beds are found still containing the water, usually salty, which was entrapped at the time of deposition. This "Fossil Water" is called also "Connate Water." See also DRILLING; SEDIMENTATION. S. F. K.

BIBLIOGRAPHY.—O. E. Meinzer, *The Occurrence of Ground Water in the United States*, 1923.

WATER BEETLE, the popular name for many species of aquatic beetles, most of which belong to the four families *Halplidæ*, *Dytiscidæ*, *Gyrinidæ* and *Hydrophilidæ*. Members of the first family are small, and commonly called crawling water beetles. The *Dytiscidæ* are large predaceous diving beetles. Whirligig beetles belong to the family *Gyrinidæ*. The *Hydrophilids* are large insects known as water-scavenger beetles. Larvæ of all these beetles are aquatic. Their bodies are elongate and more or less boat-shaped. Many of them are predaceous, though the larvæ of one family feed on filamentous algæ. Members of these families prefer quiet water. The riffle beetles are small forms which prefer flowing water.



WATER SCAVENGER BEETLE
Hydrophilus triangularis

They clamber about on the surface of logs and stones beneath the water. These beetles belong to several families other than the four already named. The larvæ of one of the best-known riffle beetles are known as "water pennies." See also WATER TIGER; WHIRLIGIG BEETLE. J. R. T.

WATER BOATMAN, the popular name for hemipterous insects of the family *Corixidæ*. Bodies of these insects are flattened above and somewhat oval. Their middle legs are long and slender and the hind legs are flattened and fringed with hairs, thus serving as oars. When at rest they anchor themselves by their claws near the bottom of the pond. A thin envelope of air surrounds the body, glistening like silver as they move. Occasionally they float on the surface, and can take flight from the water. They

feed largely on minute plants and animals in the ooze at the bottom of the pond.

WATERBUCK, any antelope of the African genus *Kobus*, specifically *Kobus ellipsiprymnus*. They are of large size, have yellowish-gray coats with the faces black, and the males carry rather long and powerful ringed horns, curving forward. These antelopes, which abound through eastern Africa, are grazers, and are seldom found far from rivers, where bushes and reeds afford shelter. Swimming well, they sometimes take to the water when in danger from lions or leopards. Several species were seen formerly in large herds.

WATER BUFFALO (*Bubalus bubalis*), an Asiatic animal that has been domesticated for centuries, spreading from India to Burma, Malaya, southern Europe, Asia Minor and to northern Africa. It is especially suited to warm, moist countries and is noted for its habit of lying immersed in marshes or wallows during the heat of the day. Its fondness for water makes the animal especially valuable in rice-growing countries, as it is one of the few that can be used in half-flooded rice fields. Water buffalo have a pronounced antipathy to white men.

Water buffalo are dun or mouse-colored and nearly destitute of hair. Their long, fattened horns curve backward, rather than forward as in most members of the ox family. Besides being used as beasts of burden and draught animals, they are valued for flesh, milk and skin. The buffalo's strength is enormous, though it is not as docile as the zebu (humped ox of India) or the ox (*Bos taurus* of northern Europe and North America). Unlike the zebu, it is still found wild in India, and tame animals soon revert to a wild state when freed. G. E. F.

WATER BUG, any aquatic bug may be called a water bug, but the term is usually applied to members of the family *Belostomatidae* or giant water bugs. All have wide, flattened bodies, and fore legs fitted for grasping prey. They eat other insects as well as snails and small fishes. They often fly from one pond to another, and are frequently attracted to lights. See ELECTRIC LIGHT BUG.

WATERBURY, a city of west central Connecticut, and one of the county seats of New Haven Co., situated on the Naugatuck River, about 32 mi. southwest of Hartford. The transportation facilities include the New York, New Haven and Hartford Railroad and electric and bus lines. Waterbury has good water power and is an important industrial center. Among the leading manufactures are brass and copper goods, clocks and watches. In 1929 the value of manufactures was about \$157,000,000, the retail trade amounted to \$51,045,807. The settlement was founded under the name Mattatuck, as part of Farmington township in 1677, but in 1688 was incorporated as a separate township. In 1853 Waterbury received a city charter, consolidating in 1901 with the township of that name. Pop. 1920, 91,715; 1930, 99,902.

WATER COLOR PAINTING. With the exception of private or preliminary sketches by many out-

standing artists, including ALBRECHT DÜRER, Baroccio, PETER PAUL RUBENS, JACOB JORDAENS, Van Dyck, Adriaen van Ostade and Van Huysum, the art of water color painting was practically neglected during the great period of European painting of the 16th, 17th and most of the 18th centuries. England has been the scene of the greatest activity, many artists working exclusively in water color and practically all of the leading artists doing some work in the medium.

Samuel Scott (1710-72), a marine and landscape painter, was one of the pioneers in English water color though he also worked in oil. To him in the strictest sense more truly belongs the title "Father of the English School of Water Color" than to Paul Sandby (1725-1809) to whom the honor is usually given. Sandby's Welsh and Windsor sets of aquatints, published 1775-80, are representative of his best work. Of these his *Windsor Castle from the Northwest* is outstanding and is characterized by animation of design and excellent topographical draughtsmanship. Thomas Hearne (1744-1817) worked in a manner similar to Sandby and was greatly influenced by THOMAS GAINSBOROUGH (1727-88) who did much experimenting in water color and painted many landscapes in the medium.

Alexander Cozens (?-1786), a natural son of Peter the Great of Russia, was a well-known teacher of painting though but little is known of his works. He carefully trained his son, John Robert Cozens (1752-97), who began to exhibit at the age of 15 and has had few peers in the field of landscape painting. John Cozens was the first of the really great English water color artists and a notable forerunner of Girtin and JOSEPH M. W. TURNER who brought the art to its highest significance.

The spirit of the work of Thomas Girtin (1775-1802) is thoroughly national and is characterized by both boldness and simplicity as exemplified by two representative paintings, *View on the Wharf* and *Kirkstall Abbey*, in the Victoria and Albert Museum. In many respects he had a more important effect on the evolution of water color painting in England than did his great contemporary Turner (1775-1851) who was more of the capricious individualist. Turner worked with a predetermined color scheme, making no attempt to imitate the exact hues of nature. His works may be divided into three distinct periods of which *Ivy Bridge* in the National Gallery, London, *Scarborough Castle* and *Boys Crab-Fishing*, Wallace Collection, are masterpieces of the second or best period when Turner was between 30 and 40 years of age and worked with perfect equilibrium of color and composition.

Though he worked largely in oils, JOHN CONSTABLE (1776-1837), an uncompromising realist, had an important influence on landscape water-color painting. Thomas Rowlandson (1756-1827), a painter of the world as it appears to the average layman, and WILLIAM BLAKE (1757-1827), who dwelt apart in realms of the supernatural and figurative, were contemporaries. Blake, who may be called the forerun-

ner of the Romantic period in art, had a marked effect upon such artists as Dante Gabriel Rossetti (1828-82) and SIR EDMUND BURNE-JONES (1833-98), both of whom did water color of distinction and artistic merit.

In the first half of the 19th century there were a large group of water color artists including John Sell Cotman (1782-1842), Peter De Wint (1784-1849), Samuel Prout (1783-1852), David Cox (1783-1859) and William Henry Hunt (1790-1864), all of whom were chiefly followers of Turner. Of their works only the landscapes of Cotman are at all comparable to those of Turner. Because of physical incapacity, Hunt was forced to limit himself almost exclusively to still life and humorous and sentimental genre.

FORD MADOX BROWN (1821-93) was for a short time the teacher of Rossetti through whom he came into contact with the Pre-Raphaelite Brotherhood. Rossetti worked principally in water color. His paintings, of which that of the Borgia family, painted in 1863, is a famous example, are characterized by a bold color scheme and animation of design. Other leading water color artists of the latter part of the 19th century are Frederick Walker (1842-75) and Randolph Caldecott (1846-86).

Many names are outstanding in the present day British school of water color painting. W. Russell Flint, a painter of shoreline subjects and landscapes, works with a command of his technique which produces almost magical results. The unusual effects of Cecil A. Hunt are frequently achieved on bristol board. His technique involves a combination of transparent water color and tempera, applied in a manner known only to him. Dame Laura Knight, a constant experimenter and innovator, has recognized the peculiar province of water color to be that of enhancing the value of a drawing. Percy Lancaster began his career as an architect and is also an etcher. He is a master of his water color medium, and his architectural training is evidenced in the careful planning of compositions. Among other contemporaries are Walter W. Russell, George Clausen, Harry Watson, J. Littlejohns and James McBey.

Among the French artists, PAUL CÉZANNE (1839-1906) did exquisite work in water color. His paintings in the medium are almost exclusively landscapes and still life and are characterized, as was all his work, by their dynamic use of pure clear color. The water color sketches of nude figures drawn by AUGUSTE RODIN (1840-1917) as preliminary studies for his sculpture are famous and are frequently seen in exhibitions. Odilon Redon (1840-1916) was a painter of fanciful poetic subjects well adapted to the water color medium. Pierre Dubaut, who works exclusively in water color, is essentially a painter of horses and has been acknowledged in Paris as the master of equine subjects. Kees Van Dongen, a Dutchman by birth, lives in Paris and paints sophisticated Parisian society, frequently with a trace of caricature. The delightful work of Marie Laurencin is typically feminine and typically French.

In America. Water color is important in the history of American art, particularly in the field of landscape painting. The large detailed pictures of the HUDSON RIVER SCHOOL were practically all built up in the studio from water color sketches made direct from nature. Kensett, Gifford, Leutze and Hicks have left sketches of lasting charm. The medium of water color has always been a favorite with the outdoor artist in gathering material for study and experiment, its swift handling enabling him to fix salient yet fleeting atmospheric effects and the brilliancy of vibrant color. The artist with mastery in the handling of oils has almost invariably produced the finest water colors. This is strikingly true of Innes, Wyant and Martin. The water color work of WINSLOW HOMER has a value and importance distinct from his sea pictures in oils. He handled the medium very skillfully to express a different set of ideas, as in his semi-tropical scenes. The same was true of John La Farge who independently worked out a luministic method in his South Sea sketches. His designs and plans for mural decorations and stained glass were first carried out in water color. Sargent and Whistler turned to water color in feeling and method as to another art, producing their best work in this medium in their mature years as a recreation rather than as a task.

Among those who have gained distinction as water color artists are Edwin Abbey, Dodge MacKnight, Childe Hassam, Walter Gay, Charles Demuth, Maurice Prendergast, Arthur B. Davies, Robert Blum, Francis McComas, Charles Burchfield, Rockwell Kent, John Costigan, Henry Snell, Henry Ranger, John Marin, George Luks and Francis Murphy.

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WATER COLOR PRINTING, a process of printing with water color inks, patented in 1921 by Jean Berté. In ordinary COLOR PRINTING, oil or varnish inks are pressed onto the paper and dried, without being much absorbed by the paper. In the water color process, however, the ink is laid on the paper and almost instantly absorbed. Soft, porous paper are necessarily used. As it does not form a heavy coating of ink on the paper, the new process permits of unusual color overlapping. For broad poster-like effects, with brilliant or contrasted colors, especially as used in advertising printing, the water color process is unexcelled.

WATER CRESS (*Nasturtium officinale*, known also as *Roripa Nasturtium-aquaticum*), a small creeping or floating perennial of the mustard family extensively used as a salad plant. It is a native of Europe very widely naturalized in ditches and stream throughout North America. The smooth, somewhat fleshy stems bear pinnate leaves with roundish leaflets. Small white flowers in narrow clusters and short many seeded pods. The plant, which thrives in clear cold, running water, is often planted in spring-fer-

streams and gathered during the growing season for sale in city markets.

WATER DISTRIBUTION of a city or town is accomplished by a system or network of underground pipes with fire hydrants, valves and other accessories, together with such **RESERVOIRS**, tanks and **STAND PIPES** as may be connected with it for the purpose of meeting the draft made on the system by consumers. The system receives water from trunk mains and distributes it over the area of the community to be served. Its design is governed by the necessity for adequate distribution, over the entire system, of the water used for domestic and industrial consumption and also for supplying the unusual demands for the extinction of fires. For ordinary service in residential districts, pressures from 25 to 40 pounds per square inch are required. For separate high pressure fire systems pressures run as high as 600 pounds per square inch. The fire flow which should be available on any one block in a residential district of small dwellings should supply not less than two fire streams of 250 gallons per minute each. *See also FIRE PROTECTION.* Where the district is closely built up or buildings are residences of high cost, 1,500 to 3,000 gallons per minute are needed, and 6,000 gallons per minute are required in densely built districts of three-story buildings.

Distribution systems consist of primary feeders of large pipes, widely spaced, conveying water in large quantities to various points for local distribution through secondary feeders which form a network of pipe of intermediate size to carry required fire flows and to feed the small (generally six to eight inches) mains supplying consumers. In the larger cities no distribution pipes are less than six inches in diameter, and are made of cast iron up to 36 inches—although steel pipe is coming into more general use for the larger sizes. E. E. W.

WATER FALLS, a stream, plunging over a vertical cliff or a less abrupt declivity in its bed. Falls of great height and volume, as Niagara Falls and Victoria Falls, are often termed cataracts. The most common cause of falls is the occurrence of bands of soft rock across a stream bed which, eroding faster than harder rock upstream, cause a sudden drop of water.

The crest of a waterfall is constantly changing as it eats back irregularly into the rock. At Niagara the undermining of weak shales underlying the hard crest causes occasional heavy rock-falls, as in January, 1931. The Canadian fall is receding at an estimated average of about two feet a year.

To the scenic beauty of falls is added the vast economic importance of their waterpower. This, transformed into electricity for manufacturing enterprises has developed scores of American industrial centers, exemplified at Minneapolis, Minn., and Rochester, N.Y.

WATER FLEA, the common name for tiny crustaceans commonly found in fresh and salt water. Originally it belonged to the members of one order (*Clado-*

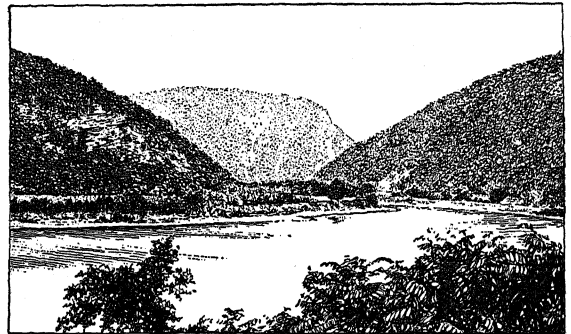
cera) but the name is popularly given to related forms. The true water fleas have transparent bivalve shells, similar in form to a clam shell. Their heads have two large eyes, which sometimes are fused into one. They row themselves through the water, using their long two-branched second antennae for oars. Their eggs are carried in a brood pouch on the back. These eggs are of two sorts. The ordinary summer eggs do not require fertilization and are very numerous. Usually only females may be found during the growing season. But resting eggs, which are much fewer in number, are laid in the fall in cold countries, and in the dry season in hot ones, and must be fertilized. At the appropriate time males, as well as females, develop.

Water fleas are very important in the economy of Nature, for all sorts of small carnivorous water-dwellers feed upon them. They are exceedingly prolific and feed on the microscopic plants that abound in all waters.

WATERFORD, the chief town of County Waterford, Irish Free State, lying on the Suir, 4 mi. from its confluence with the Barrow at the head of the tidal estuary of Waterford Harbor, 111 mi. southwest of Dublin. Acquiring importance under Danish dominance, it became a port associated with many English kings, was prominent in the anti-government and anti-Protestant rebellions of the reign of James I, and was the only Irish town successfully resisting Cromwell. Among many antiquities, Reginald's Tower upon the site of a Danish tower of 1003 and the town fortifications survive, as well as several early hospitals.

To-day Waterford has many public buildings, a modern Protestant cathedral occupying the site of a Danish church and a modern Roman Catholic cathedral and college. With its well-sheltered harbor, it carries on a shipping trade, and markets agricultural produce, cattle and salmon of the region. Pop. 1926, 26,647.

WATER GAP, the resultant notch, or gorge, when the valley of a broad river sharply narrows, as the



DELAWARE WATER GAP, NEAR STROUDSBURG, PA.

river cuts its way through a high ridge of resistant rocks. The constriction is due to the greater time required by the stream to widen its bed in the hard strata than in the weaker rocks on either side of

and yellow markings produced in spikelike clusters. The plant is held high in the water by the inflated bases of the leaf-stalks which act as floats. In the inland waters of Florida, Argentina, Australia and other warm countries the water hyacinth grows in immense profusion often choking waterways and impeding navigation.

WATER LETTUCE (*Pistia Stratiotes*), a floating perennial of the arum family, native to warm regions and often grown in aquariums. In the United States it is found in slow streams from Florida to Texas. It is a tender plant with elongated feathery roots which usually do not become attached to the bottom. The rosette of light green, wedge-shaped leaves resembles that of a partly grown plant of head lettuce.

WATER LILY, the common name for a large genus (*Nymphaea*) of aquatic plants of the water lily family. There are about 40 species widely distributed in temperate and tropical regions seven of which are found in North America. Several species, together with numerous gardeners' hybrids, are extensively grown in water gardens. They are vigorous perennials growing in shallow water with stout, fleshy, sometimes tuberous rootstocks and usually floating, orbicular or oval heart-shaped or shield-shaped leaves. The large, often exceedingly beautiful flowers either float or are borne near the surface; later the compound fruit composed of numerous carpels containing starchy, often edible seeds ripens under water. The best known North American species are the fragrant water lily (*N. odorata*), with pinkish-white flowers, and the tuberous water lily (*N. tuberosa*), with pure white flowers, both found in the eastern United States and frequently cultivated. Among exotic species grown as ornamental aquatics are the blue lotus of Egypt (*N. caerulea*), the blue lotus of India (*N. stellata*), the white lotus of Egypt (*N. Lotus*), the red lotus of India (*N. rubra*) and the white water lily of Europe (*N. alba*). The yellow water lily (*N. mexicana*), found in Florida and Mexico, is fairly hardy in cultivation. The closely allied Brazilian water lily (*Victoria regia*) bears floating leaves 3 to 6 ft. across turned up at the edges and immense fragrant flowers a foot across, varying from white to pink and red.

WATERLOO, a town of Waterloo Co., Ontario, Canada, adjoining Kitchener and situated on the Canadian National Railway, near the Grand River, about 58 mi. west of Toronto. Waterloo is a trading point for the surrounding fertile farming district, and also, a fire and life insurance center. Among its manufactures are boots, shoes, brushes, brick, beer, farm implements, furniture, foundry and mill products and spirits. There is a good airport. Pop. 1921, 5,883; 1931, 8,110.

WATERLOO, a city in eastern Iowa, the county seat of Black Hawk Co., situated on Cedar River, 65 mi. northwest of Cedar Rapids. Bus and truck lines and four railroads serve the city. The Waterloo Airport is near by. The river furnishes hydro-electric

power which enables Waterloo to engage in the manufacture of tractors and farm implements. There are also packing houses and factories producing well-drilling machinery and automobile accessories. In 1929 the industrial output amounted to \$85,000,000; the retail trade reached a total of \$28,903,073. The countryside is excellent for farming and stock raising. The headquarters of the Dairy Cattle Congress and of the International Belgian Horse Show are located here. Waterloo was founded about 1849; chartered in 1868. Pop. 1920, 36,230; 1930, 46,191.

WATERLOO, BATTLE OF, the encounter on June 18, 1815, between the French forces under Napoleon, numbering 124,588, and the allied British, Netherland and German troops, commanded by the DUKE OF WELLINGTON and the Prussian general, Gebhard von Blücher, numbering 213,671. The battle, the last in which the French Emperor engaged, resulted in catastrophe for Napoleon and led to his second and last exile. It was fought from two to four miles south of the Belgian town of Waterloo, eight miles south by east of Brussels, the coalition forces facing south and opposing Napoleon's further progress northward. For details of the Emperor's reentry into France from Elba, and the Hundred Days, see NAPOLEON.

Early in June 1815 Napoleon, aware of the fact that the Allies at the Vienna Congress had anathematized him as the "disturber of the peace of the world," and formed a coalition against him, determined to assume the offensive and move north into Belgium. His purpose was to defeat separately the respective armies of Wellington and Blücher before they were able to unite. The French forces consisted of 89,415 infantry, 11,578 artillery troops equipped with 344 guns and 23,595 cavalry. Between June 6 and June 14 Napoleon succeeded in moving this force from France to points immediately south and southwest of Charleroi, while Wellington and his forces scattered around Brussels, and Blücher had outpost lines thrown before Charleroi. The coalition forces amounted to 69,829 infantry, 11,879 cavalry and 9,406 artillery forces with 196 guns, under Wellington, and 99,715 infantry, 11,897 cavalry and 9,360 artillery troops with 312 guns under Blücher. In the three-day engagement of Charleroi-Waterloo the Allies outnumbered Napoleon by 89,083 troops of all services.

The French advance northward was launched June 13, and by June 15 it had forced Blücher's southerly outpost force back upon Fleurus; accordingly Napoleon quickly occupied Charleroi. On June 16 his pursuing army, commanded by MICHEL NEY, met Wellington with 25,000 men at Quatre Bras, and the French momentum was temporarily checked. Meanwhile Napoleon, to disrupt Wellington's plan to effect a junction with the Prussians, pursued Blücher to Ligny, and defeated him severely. Prussian casualties were 12,000 and Blücher was himself wounded. Ligny was Napoleon's last victory, for at this point the emperor made a historic miscalculation: he assumed that Blücher's forces were routed whereas, in

fact, after Ligny a substantial Prussian force had retired northward toward Wavre, planning eventually to join Wellington. Meanwhile, beginning on June 17, Napoleon with most of his forces followed after Wellington who, despite his success at Quatre Bras, had been forced to keep his strength roughly in line and parallel with the Prussian retirement east of his position. Wellington stopped on the heights of Mont Saint Jean, 4 miles south of Waterloo, on the Charleroi-Brussels road, expecting Blücher to join him by way of Wavre-Ohain. Napoleon was unaware that the union could be effected until he realized his mistake the next afternoon. On the evening of June 17 Napoleon drew up his forces, then consisting of 48,950 infantry, 15,765 cavalry and 7,232 artillery men with 246 guns (total effectives of 71,947) on the field of Waterloo in two lines laid diagonally across the Charleroi-Brussels road, his right on Frischermont, his left on the other side of the pike and extending to Nivelles. At a distance of 1,300 yards from his center, Wellington's main force held the line extending from Braine la Leud on the west to Ohain and Wavre on the east, whence the Prussians arrived at Waterloo the next afternoon. Wellington's forces on the eve of Waterloo consisted of 49,608 infantry, 12,408 cavalry and 5,647 artillery with 156 pieces. Thus at the Battle of Waterloo proper, until the arrival of the Prussians under General F. W. von Bulow, Napoleon outnumbered Wellington by 4,286 men.

The battle opened at 11:30 A.M. the following day, June 18, with a French feint on Wellington's right, to divert the latter's attention from his center, which Napoleon had boldly determined to strike, unsuspecting that the Prussians would arrive later upon his own right. A fierce artillery attack on the Duke's center, beginning about 12:15 P.M., was, in part, nullified by the Anglo-Dutch position behind the Saint Jean heights. When the wave of shells ended, and Ney prepared to advance, Napoleon sighted the Prussians arriving from the northeast. Ney twice failed to take La Haye Sainte, the Allies' center, and by 4:30 P.M. Bulow's cavalry and artillery were both in full action on the French right. Nevertheless by 6 P.M. Ney had succeeded in taking La Haye Sainte, but Napoleon, attacked on his right and left, and with Prussian shells falling on the Charleroi road in front and rear (his avenue of retreat), was unable to maintain the offensive. Two hours later the French right was penetrated and soon afterward the Emperor's forces, save for the far east detachment futilely engaging a limited Prussian force at Wavre, were in flight. Three days later Napoleon arrived at Paris with a handful of his Guards. French losses at Waterloo were about 40,000; the combined Anglo-Dutch and Prussian forces lost 22,000.

BIBLIOGRAPHY.—H. Houssaye, 1815, *Waterloo*, 1905; A. F. Becke, *Napoleon and Waterloo*, 1914.

WATERLOO BRIDGE, in London, England, an important bridge across the Thames, between Blackfriars Bridge and Charing Cross Bridge. Built in 1811-17 by John Rennie, it is a granite structure of

nine spans, 1,239 ft. long and 42 ft. wide. Canova, the Italian sculptor, called it "The noblest bridge in the world."

WATERMARKS, emblems or designs in paper formed by dies during the process of pressing wet pulp into sheets. Finely woven brass wire gauze with the watermarking design pressed into it by electrotype dies is placed in the pulp mold and, under the pressure required for making the paper, makes an imprint of the design in the fibers of the pulp.

WATERMELON (*Citrullus vulgaris*), a coarse, trailing annual of the gourd family, extensively cultivated in warm temperate countries for its large pulpy refreshing fruit. It is a native of tropical and southern Africa, especially abundant in the Kalahari Desert; the wild fruit is eagerly eaten by the natives and by grazing animals. The watermelon was grown in the Nile valley by the ancient Egyptians who represented it in their paintings.

The watermelon plant is a long-running, hairy vine bearing oblong, heart-shaped, pinnately divided leaves on short stalks, light yellow, somewhat wheel-shaped, five-lobed flowers, produced singly in the leaf axils, and a very large, berry-like, oblong fruit (pepo) with a smooth green or striped rind surrounding sweet, usually red flesh containing numerous flat seeds. The commonly cultivated varieties are classified by F. W. Rane in six groups: light-green, medium-green, dark-green, light-striped, dull-striped and mottled-green. Under cultivation the watermelon often grows 1½ to 2 ft. long and attains a weight of 20 to 50 lbs. A

WATERMELON PRODUCTION, U.S.,

4-Year Average, 1927-30

Division	Acreage	Production (Melons)	% of Tot. Prod.
UNITED STATES	208,208	66,244,000	100.0
LEADING STATES:			
Georgia	66,603	23,256,000	35.1
Florida	35,590	10,085,000	15.2
California	12,505	8,714,000	13.1
Texas	33,445	7,817,000	11.8
South Carolina	13,285	4,289,000	6.5
Alabama	8,403	2,416,000	3.6

variety with very firm flesh and a solid rind, commonly called citron, is sparingly grown for making preserves and sweet pickles. In the United States the commercial crop for 1929, grown on about 290,000 acres, amounted to nearly 70,000 carloads of 1,000 melons each, with a total value of \$14,190,256, grown chiefly in the states of Georgia, Texas, Florida, and California.

WATER METERS measure water delivered to domestic and commercial consumers, and are divided into three classes: 1. Displacement meters are known by the characteristic action of the piston as: a. reciprocating, b. rotary, c. oscillating and d. rotating disc meter. They are positive in action and displace a fixed quantity of water for each stroke or revolution; 2. Current meters differ from each other mainly in the shape of the wheel or propeller. They are not

positive in action but record the flow by the number of revolutions of their wheel or propeller; 3. Compound meters consist of the combination of a main line meter for measuring large flows and a small by-pass meter of the displacement type for small flows, with an automatic mechanism for diverting small flows through the by-pass meter. *See also* VENTURI METERS.

E. E. W.

WATER-MOCCASIN, called also cotton-mouth, popular names for a species (*Agkistrodon piscivorus*) of pit-viper, found in the southern part of the United States. It is one of the most poisonous North American snakes. In color it is brownish or olive, with blackish bars and blotches about the mouth. The inside of the mouth is white. It is a thickish snake, with a broad head, and sometimes attains a length of 5 ft. Moccasins are seldom found far from water. They are semi-aquatic, and live mainly on fish, frogs and other snakes. If frightened, they seek to escape by swimming, and do not strike unless startled, or in self-defense. Captive specimens are very docile, and will even permit themselves to be handled without any signs of annoyance.

WATER OUZEL, called also dipper, a genus (*Cinclus*) of medium-sized song birds, allied to the wrens and thrushes, most numerous in the Old World. They frequent the banks of rushing mountain streams, and are remarkable for their habit of swimming under the surface or running on the bottom in search of mollusks and insects. The American water ouzel (*C. mexicanus*), better known as dipper, found in and west of the Rockies from the Yukon to Guatemala, is about 8 in. long with dense, grayish and brownish plumage and a sweet, wren-like song. It builds a bulky dome-shaped nest among rocks near running water, and lays 3 to 5 white eggs. *See also* DIPPER; OUZEL.

WATER POLO, a competitive sport played in an indoor or outdoor tank between two teams of seven players each. The field, or water area, should be between 19 and 30 yards long, and not more than 20 yards wide. The waterproof ball is inflated and measures from 26½ to 28 inches in circumference. The goals at both ends are 10 feet wide, with a horizontal bar 3 feet above the surface of the water. Each team has three forwards, one half-back, two backs, and a goal keeper. The object of water polo is to pass the ball between the opponent's goal posts and under the crossbar. A match is divided into two periods of 7 minutes each with a rest of 3 minutes between halves. It is this brief because of the exertion of the game. Water polo is popular in colleges in the United States, England and Europe.

WATER POWER, energy obtained by utilizing the kinetic and potential energy of falling water in driving a water turbine or water wheel. *See* TURBINES, WATER. The amount of power varies directly with the fall or "head" through which the water descends and with the quantity of water flowing per unit of time. The unit of measurement is one horsepower, which is developed by one cubic foot of water descend-

ing each second through a vertical distance of 11 feet, if, as is usually the case, 20% of the total energy is dissipated during the descent.

The U.S. Geological Survey estimates the potential water power of the world at 460,000,000 horsepower, nearly half of which is in Africa, one-fourth being in the basin of the Congo River. North America has 68,000,000 potential horsepower, half of which is in the United States. The developed water power of the world amounts to an installed turbine capacity of 40,000,000 horsepower, of which 15,000,000 is in the United States and the same in Europe. Washington stands first among the States in potential water power, while California ranks first in developed horsepower. The most noted water power site in the world is Niagara Falls.

Stored Water Power is water power that is developed from stored water in contrast to that developed from natural water flow. The term is applied specifically to power obtained by using water which has been pumped into a RESERVOIR by surplus steam power, either at night or during other periods of low demand for power; or by surplus power from run-of-river plants during flood seasons. Power is generated from this stored water during periods of large demand or of drought to supplement that produced by steam or natural flow. Large plants of this type are operating in Europe, but so far there is only one in America.

F. K.

BIBLIOGRAPHY.—H. K. Barrows, *Water Power Engineering*, 1927.

WATERPROOFING, a treatment applied to materials to make them water-repellant.

Fabrics are coated or impregnated with materials such as varnishes; bitumens; coal tar; drying oils; insect, vegetable or mineral waxes; resins and gums; petroleum distillation products or metallic soaps and resins, either molten, in a water-emulsion, or in a volatile solution. Felts and cotton, woolen or linen cloths are waterproofed, or "cravenetted," by soaking in basic aluminum acetate solution. They are then heated to eliminate acetic acid, leaving the water repellent aluminum hydroxide on the fibers. Tent fabrics are rainproofed by this process, by impregnating with volatile solutions or by immersion in water emulsions of waterproofing materials. Woolen clothing and uniforms have been waterproofed by spraying or dipping in solutions or emulsions of lanolin, sometimes after an aluminum oxide treatment. Paraffine and vulcanized rubber are frequently used for waterproofing, as are oxidized vegetable oils. Pyroxalin mixed with colors, pigments and softeners is applied to textile foundations to make artificial leathers. W. H. A.

Concrete and Masonry are waterproofed by various methods. Of the most important, one consists in the incorporation of a water-repellent compound at the time of mixing. This compound is added for the purpose of producing a mass more impervious to the passage of water than plain concrete would be. Obviously, this kind of waterproofing is not effective in preventing the passage of water if

cracks develop. A second method of waterproofing which is used with considerable success consists in coating the finished walls and floors with special preparations, a coating of which is applied to the inside face of the wall, or to the top of the floor. Great care must be taken to obtain a bond with the concrete surfaces. With the use of this method it is also practicable to stop leaks which may develop through cracks in the concrete.

A third method is considered the most reliable, and consists in the protection of the outside surfaces of the walls and floors exposed to water or dampness with several layers of roofing felt embedded in ASPHALT. In the case of floors, the usual procedure is to lay a two- or three-inch base course of concrete with a wood float finish and on this place the waterproofing materials. The structural concrete floor slab, reinforced to take water pressure if necessary, is then poured on top of the waterproofing. For walls, a four-inch auxiliary wall of brick or tile is usually constructed and the waterproofing applied to its inner face. The reinforced concrete wall is then poured against this auxiliary wall, care being taken not to rupture the layers of waterproofing. Special provision must be made by means of metal sheet "flashings" to connect the wall and floor waterproofing.

G. A. H.

WATER RICE, a name sometimes given to the Indian rice, an annual marsh grass of eastern North America producing a nutritious grain utilized for food by the Indians and largely eaten by water birds. See RICE, INDIAN.

WATERS, INTERNATIONAL, waters which are within the jurisdiction of no single state, but within the jurisdiction of more than one, or of all members of the society of nations. The high seas are common to all nations. A state has jurisdiction over all its public ships on the high seas, and its merchant vessels are subject first to international law, then to the municipal law of the flag state. Rivers forming a boundary between two or more states are international streams. Some rivers draining a large area containing a number of states have been internationalized in the interest of commerce and navigation. Such rivers are the DANUBE and the RHINE. Certain waters within the limits of states have been neutralized (see NEUTRALITY) in the interest of peace and commerce. Straits separating bodies of water composing part of the high seas are international in the sense that innocent passage is assumed. See also FREEDOM OF THE SEAS.

WATER SCORPION, a name applied to hemipterous insects of the family *Nepidae*. A long respiratory tube at the caudal end of the abdomen distinguishes them from other water insects. Two types of body occur in this family. *Nepa* represents one of these types. Its body is flat, thin and oval. *Ranatra* represents the other type, having a long slender body and long legs. When at rest, water scorpions cling quietly to water plants, the respiratory tube thrust up to the water surface. They are carnivorous, feed-

ing upon other water creatures. The front legs are fitted for grasping prey.

WATER-SHED, a crest of land separating two river valleys. Its slopes determine the direction of stream drainage. It is also termed a water-parting, or in America, a divide. Thus, the Sierra Nevadas form the water-shed between streams flowing into the Pacific and those disappearing into the arid Great Basin. The term is sometimes applied to the entire catchment basin of a river or lake. Watersheds are often lowered, or shifted in position as a result of stream erosion.

WATER SNAKE, a popular name for the common and large species of the genus *Natrix* (*tropidonotus*). Though entirely harmless these "moccasins" are often ferocious in appearance and behavior.

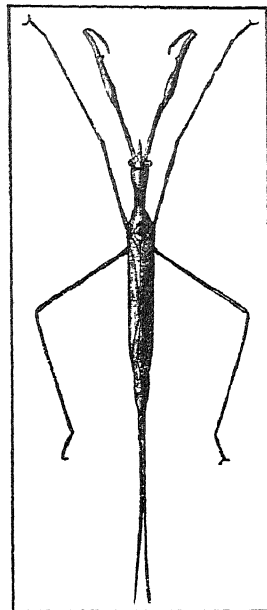
They are characterized by a banded pattern that fades with maturity. Water snakes frequent water courses of all sizes as well as ponds and lakes, but curiously enough will thrive in captivity with only enough water to drink. They prefer fish and frogs but take other small animals as well. Most of the United States east of the Rocky Mountains is included in their range. A length of 5 ft. is attained by some forms. Large litters of young are brought forth alive.

WATER SOFTENING is accomplished in large installations by adding lime, or a mixture of lime and soda ash, Na_2CO_3 . Lime alone precipitates the bicarbonates of calcium and magnesium, while in conjunction with soda-ash, both the carbonate and the non-carbonate hardness is reduced. "Soft" waters contain less than 150 parts per million total "hardness," which is measured in grains of dissolved salts per gallon—one grain per U.S. gallon being equivalent to 1,714 parts per 100,000. For smaller installations, ZEOLITES are frequently employed. See also WATER TREATMENT.

E. E. W.

WATER SPORTS, that class of amusements and games played in or over water, indoors or outdoors. This large category may be generally divided into sports played in the water, and over the water. In the first class is SWIMMING, which has steadily grown in popularity in the United States and Europe, due largely to the mounting number of indoor tanks. Swimming may be said to include DIVING as well as plunging. Another popular sport in the swimming tank is WATER POLO.

Water sports played over the surface of the water



WATER SCORPION
Ranatra fusca

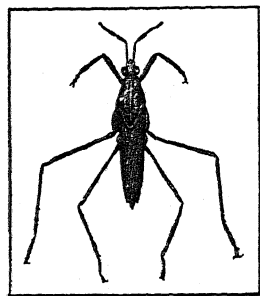
include the loose category of YACHTING, which ranges from contests between the schooner-rigged ships, America's Cup yachts, and other craft of large tonnage, to the classes for 20-foot boats and sailing canoes. MOTOR BOAT RACES are divided into competition among boats with inboard engines and those with outboard motors. Hydroplanes belong to the former class. Surf riding is the sport of riding the incoming combers on a long narrow board. In some countries surf boards are towed by motor boats. Another popular water sport is embraced in ROWING, which is divided into shell-racing, sculling, punting, and kindred events. When a rope is extended over a small stream, the familiar tug-of-war is classed properly as a watersport.

WATERSPOUT, a phenomenon occurring when a tornado passes over the sea or a lake. The funnel-shaped lower extremity of the tornado cloud in dropping nearly to the water level appears to suck up the water into it. The whole structure then speeds along the surface as one solid pillar, churning the water as it advances. Actually most of the water in the spout consists of raindrops from the tornado itself. The total quantity of it is relatively small, in spite of the enormous size, some 20 feet in diameter and 250-300 feet high.

The duration of a waterspout is comparatively brief, seldom lasting more than half an hour, and the destruction wrought is due in large measure to the violence of the air currents, as in a tornado, and not to the presence of water. Waterspouts occur most frequently in low latitudes and warm seas.

WATER-STRIDER, a popular name for hemipterous insects of the family *Gerridae*, also known as

water-skaters. They skate on the surface of the water, their very long legs outspread. Beneath them in the water move the shadows caused by the "dents" in the water film, where their feet touch the surface. A velvety covering on the body holds a thin film of air, seen when they occasionally plunge downward. Numbers of them often



WATER-STRIDER
Gerris remigis

congregate on an area of quiet water. They feed on small aquatic insects and terrestrial forms which fall on the water. They may even leap into the air to catch some passing insect.

WATER SUPPLY for cities and towns must be adequate, safe and potable. It may be taken from wells, natural lakes, streams or impounding reservoirs. Investigations into possible sources of water supply for a community must take into consideration the probable per capita consumption and the estimated growth in population. This should be compared with the quantity of water procurable. This study entails the collection of accurate information about ground-water levels, rainfall, CATCHMENT AREAS, RUN-OFF and

stream flow, except where the source is a large river or natural lake.

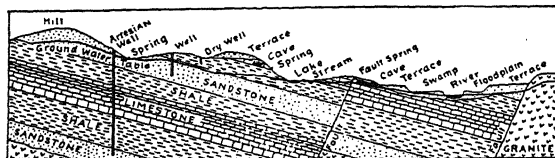
Water taken from any source may become polluted and dangerous to the public health, although there is less likelihood of this occurring when the supply is taken from deep Wells. Since 1910 the science of WATER TREATMENT, and the method of removing objectionable and dangerous qualities from contaminated water, have been so thoroughly developed and perfected that water from any source can now be rendered harmless and wholesome.

The quantity of water used daily in the larger cities of the U.S. ranges from 120 to 300 gallons per capita, the average being about 150. In the smaller cities it may run as low as 60 gallons. As the city grows, the consumption increases so that many cities have had to go far away for new and additional water supplies. New York's Catskill supply is 100 miles away, Los Angeles went 235 miles to the Owens River Valley for water and San Francisco is driving tunnels and laying steel pipe to bring water from a source 150 miles away.

E. E. W.

BIBLIOGRAPHY.—American Water Works Association, *Water Works Practice*.

WATER TABLE, in geology, refers to the upper surface of the water which nearly everywhere saturates the ground at a certain depth. Water penetrating



COURTESY AMER. MUS. OF NATL. HISTORY

GROUND WATER PROFILE—IDEALIZED SECTION

Note the contour of the water table with reference to that of the ground above. Drawing by Chester A. Reeds

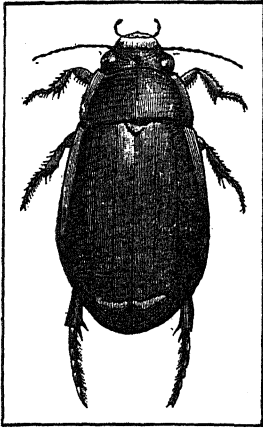
the soil, known as ground water, accumulates in or above bed rock, because friction with the soil particles prevents its rapid flow to lower elevations. The water table then follows, to some extent, the visible topography, but where it intersects the ground surface there occur swamps, springs, lakes, and streams. Wells must be put down to the water table to obtain water. The climate, the topography and the geological formations, all have profound influence on the water table, and its characteristics must be taken into consideration when constructing dams, reservoirs, tunnels, highways and foundations. It is of importance in mining, since WEATHERING and oxidation of ORE DEPOSITS go on above the table, but secondary enrichment below. See also WATER, UNDERGROUND; ORE ENRICHMENT.

WATER-THRUSH (*Seiurus noveboracensis*), a North American bird of the wood warbler family closely allied to the ovenbird, noted for its ringing song. It is about 6 in. long, uniform olive above and yellowish-white streaked with black below. Frequenting usually the dense growth along streams, it breeds from New York and northern New England northward and winters in the tropics. It feeds on

insects and nests on the ground, laying whitish eggs with brownish markings. Grinnell's water thrush (*S. n. notabilis*), a closely allied form, occurs in the western United States and adjacent Canada. The similar Louisiana water thrush (*S. motacilla*), perhaps even more brilliant as a songster, occurs in the eastern states as far north as Minnesota and Maine.

WATER THYME (*Elodea canadensis*), an aquatic herb of the frog's-bit family called also water weed. It is native to ponds and slow streams from Quebec to Minnesota southward to Virginia. About 1842 it was introduced into Great Britain and has since spread extensively through the inland waters of Europe, often clogging shallow water ways. The branching, submerged stems, 1 to 4 ft. long, bear small, densely crowded, nearly transparent leaves and minute, axillary flowers with very slender tubes, 2 to 4 in. long, which reach the surface of the water. In many districts, notably in Europe, the plant produces no seeds but propagates itself from small portions of the stem or root.

WATER TIGER, a term sometimes applied to the larvæ of large species of water beetles of the family *Dytiscidae*. Adults are large diving beetles, with flattened, oval bodies. They are often seen near the surface of ponds, hanging head downward, the tip of the abdomen at the water surface. Both adults and larvæ are very voracious. Larvæ have cylindrical, elongated bodies, large heads and strong sickle-shaped jaws. With these powerful jaws the water tiger seizes its prey, while it sucks the juices from its body. It does not hesitate to attack animals larger than itself. When mature, it



WATER TIGER
(*Dytiscus verticalis*). Adult

leaves the water, and pupates in the ground.

WATERTON LAKES, a Canadian national park established May 30, 1895, area 220 sq. mi., situated in the southwest corner of Alberta. On the south it immediately adjoins GLACIER NATIONAL PARK in Montana. The mountains of the park, many of which are snow-capped, are noted for the richness of their coloring and form ideal settings for lakes and waterfalls. Picturesque trails to the summit of practically every peak, excellent trout-fishing, camping grounds, a government golf course and other recreational facilities make this park a favorite resort. It is reached from Cardston on the Canadian Pacific railroad and by motor roads from Calgary and Edmonton and from Glacier National Park.

WATERTOWN, a residential and manufacturing suburb, situated on the Charles River in Middlesex Co., Mass., 5 mi. west of Boston. It is served by the Boston and Maine Railroad and by trolley and

bus lines. Among the leading manufactures are rubber products, stoves and some 40 other diversified products, their value in 1929 being \$35,000,000; the retail trade in 1929 amounted to \$10,257,911. Watertown is a marketing center for numerous farms and gardens. The Federal Government maintains an arsenal there. Part of famous Mt. Auburn Cemetery is in the township. Among interesting buildings are Coolidge's Tavern, where Washington was entertained in 1780, and the house in which the Committee of Safety met in 1775. Watertown was founded in 1630, by a group of English colonists, headed by Sir Richard Saltonstall. Pop. 1920, 21,457; 1930, 34,913.

WATERTOWN, a city of northwestern New York, the county seat of Jefferson Co., situated on the Black River, at a junction point of the New York Central Railroad, about 72 mi. north of Syracuse. The municipal airport is a port of entry. Located in a rich farming and dairying district, Watertown is a distributing point for farm produce, especially cheese and milk. Water power furnished by the Black River is utilized for numerous manufactures, including paper, machinery, silk goods and knitted garments, their value in 1929 being about \$20,000,000. The retail trade in the same year amounted to \$21,852,281. The city attracts many tourists and summer visitors because of its location within 25 mi. of the Thousand Islands, 35 mi. of the Adirondacks and 10 mi. of Lake Ontario. ROBERT LANSING, Roswell P. Flower, and F. W. WOOLWORTH, founder of five and ten cent chain stores, which had their beginning at Watertown, have been residents. The town was established about 1800 by settlers from central New York, was incorporated as a village 16 years later and in 1869 secured a city charter. Pop. 1930, 32,205.

WATERTOWN, a city in northeastern South Dakota, the county seat of Codington Co., situated on the Big Sioux River, 110 mi. north of Sioux Falls. Four railroads and bus lines serve the city. Corn, small grain, potatoes, live stock, poultry and dairying are the principal agricultural interests of the region. The local manufactures are lumber products, rugs, cigars, brooms, concrete, butter and ice cream. There is also a meat-packing house. In 1929 the retail trade reached a total of \$9,534,202. Watertown was incorporated in 1885. Pop. 1920, 9,400; 1930, 10,214.

WATERTOWN, a city in southeastern Wisconsin, on the boundary line between Jefferson and Dodge counties, situated on the Rock River, 44 mi. northwest of Milwaukee. Two railroads, an electric railway and bus lines serve the city. Butter and cheese are shipped in large amounts and it is a market for stuffed fowl. Manufactures include shoes, paper boxes, beehives and machine shop products. The retail trade in 1929 amounted to \$8,375,227. It is the seat of the Northwestern University and Sacred Heart College. Carl Schurz practised law here. Watertown was founded in 1834 and chartered in 1853. Pop. 1920, 9,299; 1930, 10,613.

WATER TREATMENT, a process necessary to safeguard the health of the public. Because of the

ease and likelihood of contamination, all water supplies taken from surface sources should have some treatment, depending upon the quality and condition of the water. The treatment of water supplied for domestic and commercial use is now so well developed and perfected that, no matter what the source, the water can be rendered safe and potable. Removal of suspended matter, reduction of dissolved solids and elimination of dangerous BACTERIA are accomplished by the use of numerous more or less complex methods supervised by experienced operators who must continually be testing, watching and altering the treatment as varying conditions require.

Some turbid waters become clear enough to be filtered after a few hours' detention in "settling" basins, while others may clear up only after many days. These must be treated with chemicals to produce COAGULATION which induces rapid SEDIMENTATION. The chemicals ordinarily used for this purpose are aluminum sulphate, or ALUM, and iron sulphate. Aluminum sulphate can generally be used as a coagulant without the addition of other chemicals, which accounts for its widespread use as compared to iron sulphate which necessitates the use of lime to prevent soluble iron remaining in the treated water. By using larger quantities of lime in raw waters carrying bicarbonates of calcium and magnesium in solution, the temporary hardness can be materially reduced. See WATER SOFTENING. The muddy western waters, though highly alkaline, are most easily coagulated with alum, if lime is also used. With waters low in alkalinity it is necessary to apply soda ash or lime to bring about coagulation and to prevent undecomposed alum remaining in the treated water.

When coagulants are applied to raw water, a reaction takes place resulting in the formation of an insoluble flocculent PRECIPITATION with which the finely divided suspended matter and the bacteria are brought into contact and the whole mass sinks. The proportion of suspended matter removed by coagulants usually averages about 90%, depending on the character and turbidity of the raw water and the amount of chemicals used. E. E. W.

WATER-TURKEY, a name applied to various species of Anhinga, large, long-necked aquatic birds of warm regions, called also darters and snakebirds. See ANHINGA.

WATERVILLE, a city of Kennebec Co., in southern central Maine. It lies opposite Winslow on the Kennebec River, about 18 mi. northeast of Augusta. The Maine Central Railroad and bus lines afford transportation. Waterville is the seat of Colby College, a privately controlled coeducational institution chartered as Maine Literary and Theological Institution in 1813. After several changes, the name Colby College was adopted in 1899. In 1930 the endowment fund amounted to \$1,464,945. The enrollment for 1931 was 695 students. The teaching staff numbered 44, headed by Pres. Franklin W. Johnson. The city has canoe and boat building yards, cotton, woolen, paper and fiber products mills. In 1929 the factory products were

valued approximately at \$9,000,000; the retail trade amounted to \$9,166,839. Though settlement began about the middle of the 18th century, Waterville was not organized as a town until 1802. It was incorporated as a city in 1883, adopting a city charter 5 years later. Pop. 1930, 15,454.

WATERVLIET, a manufacturing city in Albany Co., eastern New York, situated on the west bank of the Hudson River, opposite Troy. Two railroads and river craft afford transportation. The manufactures include iron and steel products, bells, chimes, clothing, spun silk and woolen textiles. The output, 1929, was valued at \$10,253,265. The retail business in 1929 amounted to \$2,656,590. A United States Arsenal and Gun Research Laboratory is located here. Watervliet was settled in 1825 and called West Troy; the village was incorporated in 1836; renamed Watervliet, it was chartered as a city in 1896. Near by at Niskayuna "Mother Ann" Lee and seven of her disciples in 1776 founded the first Shaker community in America, on the site of which has been erected the Ann Lee Home and Hospital. Pop. 1930, 16,083.

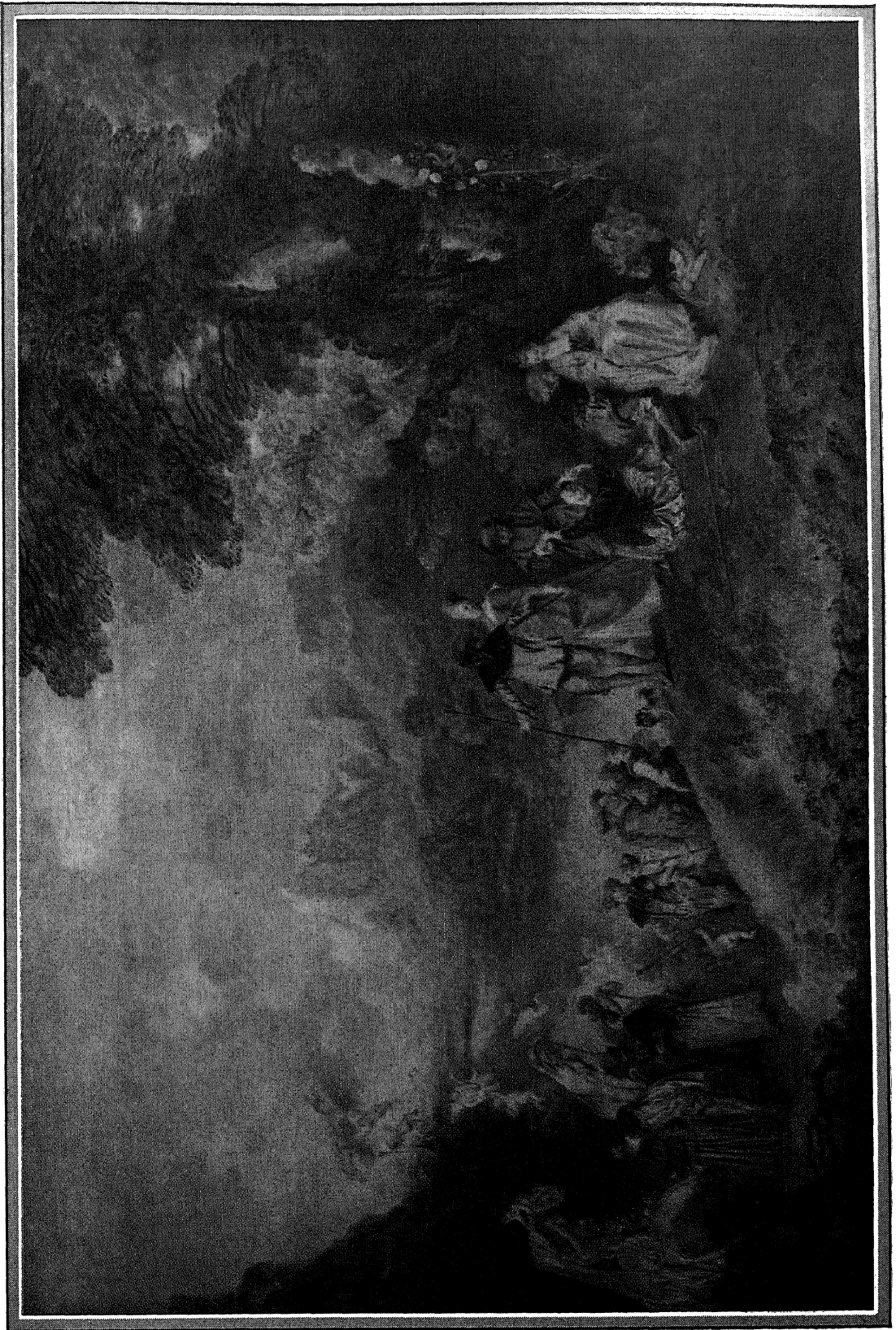
WATERWAYS are broadly water routes, channels or streams of water serving as means of communication. Waterways include navigable ways in seas, rivers, estuaries, canals, lakes, sounds, bays, harbors or other bodies. Inland waterways are those in, or formed by, rivers, canals, and landlocked bays and sounds. See INLAND WATER TRANSPORTATION.

Waterways are improved by dredges, training works, regulating works, canalization, and other means. *Aids to navigation* are required in connection with coastal and inland waterways, harbors, and the like, consisting of lighthouses or lightships to mark promontories, reefs, shoals, and entrance channels; buoys, spars or other markers to indicate shoals, inlets, and channel locations and limits; range towers, boards and lights to indicate courses of channels or fairways; also fog signals, radio ranging stations, and other special apparatus. F. R. H.

WATFORD, a market town of Hertfordshire, England, lying in a pleasant, wooded countryside on the small river Colne, about 17 mi. northwest of London. A modernized town, among its several churches is that of St. Mary's which while displaying examples of various architectural dates also has some good early 17th century monumental work and an embattled tower. The much restored Church of St. James boasts an Early English chancel. Among the modern public buildings of Watford are a Library and School of Arts and two orphanages. Industrially the town engages in brewing, has malt kilns and corn mills and a sizable iron foundry. Pop. 1931, 56,799.

WATLING STREET, an old Roman road in Britain, extending from Dover to London by way of Canterbury, thence to Verulam, the modern St. Albans, and from there to Wroxeter and possibly to Chester. In Norman times it was one of the four "Royal Roads," which were under the king's protection. The name has been applied to other highways in Britain, especially in later times to the Roman

WATTEAU



"EMBARKATION FOR CYTHERA"

By Jean Antoine Watteau (1684-1721). In the Louvre, Paris.

"North Road" from York to the Wall of Pius. Watling Street was the boundary between Warwickshire and Leicestershire. There were four of these famous roads in early Britain, Watling Street, *ERMINE STREET*, Foss Way and Ikenild Street.

WATSON, JOHN (1847-), Canadian philosopher, was born at Glasgow, Scotland, Feb. 25, 1847. He was educated at the University of Glasgow. In 1872 he became professor of logic, metaphysics and ethics at Queen's University, Kingston, Ont. A profound scholar, Watson wrote a valuable interpretation of Kant; other works are *Outline of Philosophy*, *Hedonistic Theories*, *The Interpretation of Religious Experience*. In 1919 he published a volume of political philosophy, *The State in Peace and War*.

WATSON, JOHN BROADUS (1878-), American psychologist, was born at Greenville, S.C., Jan. 9, 1878. His graduate studies were pursued at the University of Chicago, where he received his Ph.D. in 1903. From 1908-20 he was professor of psychology in Johns Hopkins University. In 1924 he went to the J. Walter Thompson Co., an advertising agency. Watson is generally regarded as the leader of the behavioristic movement. He is an advocate as well as an exponent of extreme behaviorism. His experiments on babies have done much to modify the concept of instinct. His most important works are: *Behavior*, 1914; *Psychology from the Standpoint of a Behaviorist*, 1919; *Behaviorism*, 1925, and *Psychological Care of Infants and Children*, 1928.

WATSON, THOMAS EDWARD (1856-1922), American political leader, was born in Columbia Co., Ga., Sept. 5, 1856. He was educated at Mercer College and became a member of the bar in 1875. After serving in the Georgia Legislature and later as a member of Congress, he ran for Vice-President with WILLIAM JENNINGS BRYAN in 1896. The People's Party nominated him for President in 1904. From 1905 to 1906 he conducted *Tom Watson's Magazine* and then *The Weekly Jeffersonian*. In 1921 Watson became Senator from Georgia. He died in Sept. 1922.

WATSONVILLE, "The Apple City" in Santa Cruz Co., western California, on the Pajaro River, 20 mi. southeast of Santa Cruz. It is served by airplanes, buses and the Southern Pacific Railroad. Fruits and vegetables are the chief crops of the region. The city is a trade market, for apples and lettuce especially, and has fruit packing houses and cider and vinegar works. Watsonville was settled by the Spanish in 1851; incorporated in 1903. There is a stone here marking Father Junipero Serra's discovery of the Pajaro Valley. Nearby are many charming resorts. Big Basin State Redwood Park is northeast of Watsonville. Pop. 1920, 5,013; 1930, 8,344.

WATT, JAMES (1736-1819), Scottish engineer, was born at Greenock, Renfrewshire, Jan. 18, 1736, the son of a carpenter. He was educated in the town schools, and when 18 years old was sent to Glasgow to study the trade of instrument-maker. Aided by a natural bent for mathematics, and an aptitude for wood- and metal-working, he made rapid progress,

and in 1756-60 was retained by the University of Glasgow as an instrument designer. In 1764, when established independently, he was asked to repair a model steam engine. Watt carefully studied the machine, noting that its chief defect arose from the uncertain method of steam condensation. He designed a condenser independent of the cylinder. The improvement was so far-reaching that its designer has been incorrectly called the inventor of the steam engine. Watt obtained a patent on the condenser in 1769, and in 1774, with Matthew Boulton, a Birmingham manufacturer, began to construct steam engines.

Besides the condenser, he made other improvements in steam-generation, devising the sun-and-planet gear-wheel, the speed-governor, the throttle-valve, and steam-pressure indicator. In 1800, following the expiration of his patent, he retired, and made experiments in chemistry, architecture and music and studied metaphysics and languages. His capacity for varied research and the extent of his knowledge were evidenced by his discovery of the composition of water, and his invention of a machine for reproducing sculptures. He was elected to the Institute of France (one of few Englishmen thus honored), and to the Royal Society. Watt died at Heathfield, near Birmingham, Aug. 25, 1819.

WATT. See ELECTRICAL UNITS.

WATTEAU, JEAN ANTOINE (1684-1721), French painter, was born at Valenciennes, Oct. 10, 1684. After studying art in the provinces, he went to Paris where he worked under Claude Gillot. He achieved fame for his superb paintings of the lighter scenes of court life, and in 1717 was admitted to the Academy. Watteau became the outstanding portrayor of the *fête galante*, in which gorgeously costumed lords and ladies dance or stroll through beautiful woodland scenes and landscapes. One of the greatest of his pictures is the *Embarkation for Cythera*, now in the Louvre, Paris. Watteau died at Nogent-sur-Marne, July 18, 1721.

WATTENSCHIED, a German city in the Prussian province of Westphalia, in the Ruhr district, incorporated in 1926 Eppendorf, Gunningfeld and a number of other towns. It is well-supplied with vocational and other schools, and engages principally in mining mineral coal and in manufacturing wire, chemicals, brushes, spirits and bricks. First mentioned in 900, Wattenscheid became a city in 1876. Pop. 1925, 62,870.

WATTERSON, HENRY (1840-1921), American journalist, was born in Washington, D.C., Feb. 16, 1840. When the Civil War broke out he joined the Confederate army. In 1868 he founded and became editor of the Louisville *Courier-Journal* which he made one of the influential newspapers of the United States. For half a century he was a leader in the Democratic Party and prominent in public life. He died in Jacksonville, Fla., Dec. 22, 1921.

WATTHOUR. See ELECTRICAL UNITS.

WATT-HOUR METER, an instrument for measuring electric power and indicating, usually on dials, the integrated result in watt-hours, or as volts \times am-

peres \times hours. Practically every consumer of electric current is provided with a watt-hour meter located at the point where the electric current enters his premises. This meter is usually read monthly, the reading constituting the basis for the charge for the current consumed during that month. *See also* WATTMETER.

WATTLE, the name given in Australia to various native species of *Acacia*, some of which are highly valued as ornamental and timber trees. *See* ACACIA.

WATTMETER, an instrument used in the measurement of electric power, indicating the average product of the voltage and current of the circuit to which it is connected. It is an ELECTRODYNAMOMETER type of instrument, with one coil carrying a current proportional to the voltage of the circuit, and the other carrying all or a part of the circuit's current.

Two ways of connecting the instrument are possible. In one, the current coil carries the circuit current plus the potential-coil current; in the other, the potential coil has across it the sum of circuit voltage and current-coil potential drop. In the first case, the instrument indicates its own potential-coil loss, and in the other its own current-coil loss, in addition to the circuit power. Ordinarily, it is necessary to compute the value of whichever loss is present and subtract it from the reading. This is unnecessary only when the loss is small compared to the power measured, or when using a compensated instrument.

Measurements of power on high-voltage, alternating-current circuits are commonly made with the wattmeter connected to the circuit through instrument TRANSFORMERS. Besides the necessity of having adequate insulation, it is necessary that these transformers be built with accurately known ratios and small phase angles.

Polyphase-power measurements are made either with a polyphase wattmeter or with a separate wattmeter for all except one of the phases. Three-phase measurements are the most common, and, in that case, two wattmeters are necessary. These can be combined into a single instrument which indicates directly the total power. Otherwise, the separate readings of a number of wattmeters are added algebraically to obtain the total power.

W. H. T.

WATTS, GEORGE FREDERICK (1817-1904), English painter and sculptor, was born in London, Feb. 23, 1817. He studied at the Royal Academy and in Italy, where he experimented with fresco work. *Life's Illusions*, painted in 1849, and *The Good Samaritan*, 1850, Watts's first attempts to preach in paint, were followed by the famous *Hope*, 1855, in which he essayed a somewhat obscure symbolism. In 1856 he visited Paris and painted portraits of Thiers and Jerome Bonaparte; in 1857 he accompanied an expedition to Asia Minor to investigate the ruins of Halicarnassus. *Sir Galahad*, his most popular picture, completed 1862, was followed by *Time and Oblivion*, 1864, and *Thetis*, 1866. His *Russell Gurney*, in the National Gallery, London, is one of his best portraits. Watts's neo-classic sculpture is in no way remarkable. The artist died in London, July 1, 1904.

WATTS, ISAAC (1674-1748), English hymn writer, was born at Southampton, July 17, 1674. He was educated for the ministry, and after tutoring for several years became assistant pastor, then pastor, of an Independent chapel in Mark Lane, London. His *Horae Lyricae* was published in 1706, and was followed by a volume of hymns, and by paraphrases of the Psalms of David. Watts wrote about 600 hymns, and may be truly called the father of modern hymnology. (*See also* HYMN.) Among his other works is a treatise on Logick and one on geography and astronomy. He died in London, Nov. 25, 1748.

WATTS-DUNTON, THEODORE (1832-1914), English critic, authority on Romany lore, and miscellaneous writer, was born in St. Ives, Huntingdonshire, and educated privately. He was called to the bar in 1863, and studied art in Italy at Rossetti's suggestion, and subsequently became a leading art and literary critic, writing for *The Examiner* from 1874, and *The Athenaeum*, 1875, and contributing articles for Ward's *English Poets*, Chalmer's *Cyclopaedia*, etc. His most popular works were the gypsy novel, *Aylwin*, 1898, and *The Coming of Love*, 1897. He lived for many years with A. C. SWINBURNE at The Pines, Putney Hill, London, where he died June 6, 1914.

WAT TYLER'S REBELLION, the peasant's revolt of 1381 in England, caused by a variety of social and economic grievances and immediately occasioned by the imposition of the poll-tax. Under Wat Tyler's leadership the rebels from Essex and Kent advanced to London, which was for two days in their hands. The young king, Richard II, promised to grant their demands. At a second interview Tyler was killed; the king led the rebels outside the city and they dispersed. Many of their leaders were hanged, the charters granted them were withdrawn, and the insurrection collapsed as rapidly as it had arisen.

WAUGH, BENJAMIN (1839-1908), English philanthropist and social reformer, born, Feb. 20, 1839, at Settle, Yorkshire. He settled, in 1866, at Greenwich and devoted himself to child welfare, having joined the Congregational ministry the year before. One of his biggest contributions to social welfare was the founding, in London, of the Society for the Prevention of Cruelty to Children. The Criminal Law Amendment Act and the Act for the Prevention of Cruelty to Children were largely his work. From 1887 onward, he gave all of his time to the Society, resigning from his pastorate. He died at Westcliff, Essex, Mar. 11, 1908.

WAUKEGAN, a city of northeastern Illinois and county seat of Lake Co., 40 mi. north of Chicago. Its transportation facilities include the Chicago and Northwestern Railroad, and it has a good harbor. Waukegan is largely residential and, owing to its location, a popular resort in summer time. It is also industrial, manufacturing asbestos, wire products, chemicals, radio accessories and out-board motors, and handles agricultural produce of the vicinity. In 1929 the manufactures reached approximately \$32,000,000; the retail

trade amounted to \$23,615,214. Five miles south is the Great Lakes Naval Training Station. Some evidence points to the early presence of a French trading post; in any case, the settlement of 1835 was made around the ruins of a stockade and was called Little Fort. The city charter was acquired in 1859. Pop. 1920, 19,226; 1930, 33,499.

WAUKESHA, a city in southeastern Wisconsin, the county seat of Waukesha Co., situated on the Little Fox River, 16 mi. west of Milwaukee. The Chicago and North Western Railroad serves the city, which is a shipping center for fine Guernsey and Holstein cattle, also for valuable mineral waters. Waukesha has various manufactures. It is the seat of Carroll College, the State Industrial School and a United States Veterans' Hospital. The site was settled about 1836, and in 1839 was named Prairieville. Renamed Waukesha, the village was incorporated in 1852, the city being chartered in 1896. In 1929 the factory output amounted approximately to \$28,000,000; the retail trade reached a total of \$10,912,369. Pop. 1920, 12,558; 1930, 17,176.

WAUPUN, a city in southeastern Wisconsin, in the counties of Fond du Lac and Dodge, situated 19 mi. southwest of Fond du Lac. The Chicago, Milwaukee, St. Paul and Pacific Railroad serves the city. The vicinity is agricultural. Waupun has various manufactures and is the seat of the state prison and the central state hospital for the insane. It was founded in 1838 and incorporated in 1857. Pop. 1920, 4,440; 1930, 5,768.

WAUSAU, a city in north central Wisconsin, the county seat of Marathon Co., situated on the Wisconsin River, about 200 mi. northwest of Milwaukee. Bus and truck lines and two railroads afford transportation. Alexander Airport is located here. Dairying is the chief interest of this region. Lumber products, paper, granite, shoes, electric motors and various other articles are made in the city. In 1929 the industrial output was approximately \$13,000,000; the retail trade amounted to \$15,498,087. The vicinity has beautiful colored granites and numerous fox farms. Wausau was a logging camp in 1837; the city was chartered in 1872. Rib Mountain State Park, situated 1,940 ft. above sea level, is just outside the city, and Eau Claire Dalles County Park is 15 mi. from here. Pop. 1920, 18,951; 1930, 23,758.

WAUWATOSA, a city in Milwaukee Co., southeastern Wisconsin, situated on the Menomonee River. It is a suburb of Milwaukee, served by the Chicago, Milwaukee, St. Paul and Pacific Railroad. Sashes, doors and some leather goods are manufactured here. In 1929 the factory output reached an approximate total of \$12,000,000; the retail trade amounted to \$7,659,743. Wauwatosa is the seat of the Evangelical Lutheran Theological Seminary. The city was founded by New Englanders in 1847; incorporated in 1897. Pop. 1920, 5,818; 1930, 21,194.

WAVE-LENGTH, the distance between two successive crests or troughs, or other corresponding points of a wave (*see* WAVE THEORY). It is equal to the

distance traveled by the wave, or series of waves, in unit time divided by the number of waves propagated in that time. In radio, wave-length is the distance which a radio signal (*see* ELECTROMAGNETIC WAVES) will traverse in one second divided by the number of waves produced by the transmitter in that time, i.e., it is numerically equal to the VELOCITY OF LIGHT divided by the FREQUENCY of the transmitter.

WAVE-LENGTHS, STANDARD, the wave-lengths of certain spectral lines used as standard measures of length. LIGHT consists of waves traveling with a definite velocity and having a wave-length determined by the FREQUENCY of the source. This wave-length for any line in the SPECTRUM of a source is constant and can be measured directly. In view of the possible change in, or destruction of, our standards of length, such as the standard METER, it was suggested that the wave-length of certain spectral lines be used as ultimate standards. Michelson made the necessary measurements by using his INTERFEROMETER. He found that the number of waves to a standard meter for the red line from cadmium is 1,553,163.5; for the green, 1,966,249.7; and for the blue, 2,083,372.1. These figures were obtained at 15°C. and normal atmospheric pressure. P. I. W.

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WAVE MECHANICS. *See* WAVE THEORY.

WAVE METER, a device for measuring the WAVE-LENGTH corresponding to high-frequency current. In simplest form it consists of a fixed INDUCTANCE, a variable CAPACITANCE calibrated in terms of wave-length and a milliammeter (*see* AMMETER) to indicate when the condenser is adjusted for RESONANCE.

WAVERLEY, the first of the WAVERLEY NOVELS, by SIR WALTER SCOTT; published 1814. It is an exciting historical romance of the Jacobite Rebellion, 1745. Captain Edward Waverley, of the English Dragoons, while visiting Baron Bradwardine in Scotland, becomes seriously involved in Prince Charles Stuart's rebellion, chiefly through the persuasive measures of Fergus MacIvor, with whose sister, Flora, he falls in love, and for this "treachery" is held in disgrace in England. He is pardoned finally through the intercession of Colonel Talbot, an old man whose life the hero has saved at Preston Pans, and all ends happily when he marries the Baron's daughter, Rose.

WAVERLEY NOVELS, THE, the title given to the historical novels of SIR WALTER SCOTT. The largest group, dealing with Scotch history, include the following: *WAVERLEY*, published 1814; *OLD MORTALITY* and *The Antiquary*, 1816; *The Monastery*, 1820; *THE ABBOT*, 1820; *Redgauntlet*, 1824; *The Fair Maid of Perth*, 1828; and *Castle Dangerous*, 1831. The following deal with English history: *IVANHOE*, 1819; *Kenilworth*, 1821; *Peveril of the Peak*, 1823; and *Woodstock*, 1826. Two treat of Continental history: *QUENTIN DURWARD*, 1823, and *Anne of Geierstein*, 1829. Three of the Crusades: *The Talisman*, 1825; *The Betrothed*, 1825; and *Count Robert of Paris*, 1831. The remaining 11 volumes of the series are

less definitely historical, and include most notably *ROB ROY*, 1817, *THE HEART OF MIDLOTHIAN*, 1818, and *THE BRIDE OF LAMMERMOOR*, 1819.

WAVERLY, a village in Tioga Co. on the boundary line between New York and Pennsylvania, situated 18 mi. southeast of Elmira; served by three railroads. South Waverly, Athens and Sayre, boroughs of Pennsylvania, form one industrial community with Waverly. The chief manufactures are paint, furniture, gloves, silk ribbons and broad silks. The surrounding region is good farming country. Pop. 1920, 5,270; 1930, 5,662.

WAVES, the periodic disturbance, up and down, or to and fro observed in solid or elastic media, which disturbance is propagated at a certain speed without, however, moving forward the material affected. Sound waves produced in air, earthquake waves in the solid crust of the earth, and, most familiar of all, the periodic rising and falling of the water in oceans and lakes under the influence of a wind, are examples of wave motion. Although the waves of the ocean appear to run forward at great speed, the water particles themselves execute chiefly an up-and-down motion, with a slight sideways sway, and it is only the periodic disturbance which moves forward. This may be seen in a length of rope which is tied at one end, while the other end is held in the hand and periodically shaken up and down. A wave results which will appear to be traveling along the rope from one end to the other, although it is obvious that the particles of the rope cannot themselves run forward or backward but only sway.

The principal characteristics of a wave are its length, or the distance between crests; its amplitude, or the total height from crest to bottom, and the speed with which it is propagated. A definite relation exists between the wave length and the speed. In the open ocean the length is proportional to the square of the speed, so that a wave 100 yards in length has a speed of 27 miles per hour; one 700 yards in length, the longest observed, a speed of 70 miles per hour. During very severe and lasting storms heights of as much as 75 feet have been observed. The water under the crest of the wave has a forward velocity; that under the trough receives a backwards impulse. The result of this upon small objects on sloping beaches, where gravity imparts a slight outward impetus to objects once in motion, is such as to single out, for each size of objects, one particular depth, shoreward of which they are washed up on the beach, seaward of which they are towed out to sea. Waves running up a shallow sloping beach are so much retarded from underneath that the crest breaks forward to form a *SURF*, while the current of water running seaward after the force of the wave is spent is known as *UNDERTOW*.

Very small waves, such as the ripples caused in small rivers by feeble disturbances, with quick recurrence are controlled by the surface tension of the water instead of by gravity. When the wave length is 0.7 of an inch the effects of gravity and surface

tension balance, and the speed is a minimum, less than 10 inches per second. For both smaller and larger waves the speed is greater. W. J. L.

WAVE THEORY. In the solution of problems involving electromagnetic radiations (*HEAT*, *LIGHT* and *X-RAYS*) and *ELECTRONS* or *ATOMS*, the *QUANTUM THEORY* has proved successful. The dual nature of electrons and atoms, whereby they are treated as particles at one time and as waves at another, has necessitated an expansion of the earlier theory. The work has developed under Heisenberg as matrix mechanics and under Schroedinger as wave mechanics.

Essentially, wave mechanics consists of an interpretation of certain differential equations or mathematical expressions which are used to express the motion of a particle in free space or in the presence of various mechanical or electrical forces. After building up the equation by thinking of particles, the equation is looked upon as one expressing a family of wave fronts, i.e., as a wave traveling with a definite velocity and having the energy of each of its quanta related to the frequency of vibration, as in the earlier quantum theory. Without presenting the equations, it is sufficient to say that the older mathematics of particles is discarded, and a consideration of waves or vibratory motion is introduced, along with the quantum conditions, before the final solution of the equation is attempted.

The solution of such equations then yields quantities characteristic of waves rather than of particles. In addition to yielding the same results for problems as when solved by the earlier quantum theory, wave mechanics successfully copes with many new ones. The problem of the intensity of *SPECTRUM* lines, unsuccessfully studied under the particle theory, is gradually unfolding under the wave theory. Wave mechanics is replacing Newtonian mechanics, when applied to problems of atomic physics. J. B. H.

WAVE TRAP, a device consisting, usually, of an *INDUCTION COIL* coupled to the *ANTENNA* circuit of a *RADIO RECEIVER* and tuned to the *FREQUENCY* of an undesired signal. Enough energy at this frequency is absorbed to reduce *INTERFERENCE* with other signals in the radio receiver.

WAXAHACHIE, a city and the county seat of Ellis Co. in northeastern Texas, situated about 30 mi. south of Dallas. Bus lines, an interurban railway and three railroads serve the city. The chief crops of the vicinity are cotton and grain; and cotton and cotton-seed products are the principal manufactures. The region has fine mineral wells, still undeveloped. It is the seat of Trinity University, with an average enrollment of about 500 students. Waxahachie was founded in 1850 and incorporated in 1871. Pop. 1920, 7,958; 1930, 8,042.

WAXES, solid, somewhat plastic substances of animal, mineral or vegetable origin, which resemble *ORLS* and *FATS* in chemical constitution and properties. Whereas the latter, however, are compounds of fatty acids with glycerine, the waxes are chemical combina-

tions of similar acids—principally palmitic, cerotic, and melissic acids—with monohydric alcohols, such as cetyl, ceryl, and myricyl alcohol. Of the vegetable waxes only those obtained from the carnaüba palm in Brazil, and from the sugar cane are of any importance; montan wax, obtained from the distillation of peat, and ozokerite, a bituminous product, are the chief mineral waxes. Among the animal waxes may be mentioned BEESWAX, pela-wax, obtained from certain insects in China, SPERMACEIN, a mixture of oil and wax procured from the head of the sperm whale, and wool-wax from sheep. Apart from their extensive use in polishes and candles, waxes find application in the printing and dyeing of calico goods, and as a basis for modelling figures—a practice common to the ancient Egyptians—either for exhibition purposes or for scientific use. Wool-wax is also employed as an ointment under the name of lanolin, this application being based upon the fact that it is readily absorbed by the skin.

W. J. L.

WAX MYRTLE, the common name for several shrubs or small trees of the SWEET GALE family which bear small nutlike fruits covered with wax used for making candles. The North American species include the southern wax myrtle (*Myrica cerifera*), a tree sometimes 40 ft. high found from New Jersey to Arkansas and south to Florida, Texas and the West Indies; the BAYBERRY or small waxberry (*N. carolinensis*), found mostly near the coast from Nova Scotia to Louisiana, and the western wax myrtle (*M. californica*), an evergreen tree sometimes 30 ft. high, found near the coast from southern California to Oregon.

WAX SCULPTURE. From the early Egyptians to our contemporaries, wax, generally beeswax, has been a favorite material for modeling or casting works of art. Some wax figures of gods from Egyptian sarcophagi exist. The Greeks and Romans used wax also for family portraits and for children's dolls. Notable historical events, celebrated criminals and depictions of gruesome crimes are found in the exhibitions of life-size wax figures of Mme. Tussand in London and the Eden Musee in New York. An attractive modern example of wax sculpture may be seen at the Metropolitan Museum in the little wax figures, five or six inches high, incidental to the models of medieval interiors by Dwight Franklin.

The practical use of the *cire perdue*, lost wax, method in casting bronzes and other metal work has been known from remote antiquity. See also CASTING AND FINISHING.

WAX TREE, a small shrubby or sometimes tree-like species of sumach (*Rhus succedanea*), native to eastern Asia from the Himalayas to Japan. It grows sometimes 30 ft. high with large pinnate leaves of many leaflets, lustrous above and whitish beneath, and yellowish-green flowers in slender clusters. The tree produces a waxlike substance resembling beeswax used chiefly for making candles. Various parts of the tree, especially the foliage, are poisonous. The name wax tree is applied also to several woody

plants yielding waxy products, as the WAX MYRTLE and the Chinese privet (*Ligustrum lucidum*).

WAXWING, the popular name for a family (*Bombycillidæ*) of small, almost songless passerine birds, given because of the red waxlike tips on their wing feathers. There are only three species, varying from 6 to 8 in. in length, all native to northern regions, with beautiful silky brown plumage, and conspicuous crests. The waxwings move in flocks, frequenting trees and feeding chiefly upon berries, but occasionally on insects. In their bulky nests, often placed in trees or large bushes, they lay usually three to five grayish, somewhat spotted eggs. The Bohemian waxwing (*B. garrula*), with brownish-gray plumage, marked with black, white and yellow, is found around the world in boreal regions, going southward in winter to the northern United States. The cedar waxwing or cherry bird (*B. cedrorum*), so-called on account of its fondness for the berries of the red cedar and for cherries, breeds widely in temperate North America, wintering southward to the tropics. The Japanese waxwing (*B. japonica*), of eastern Asia, has no waxy appendages on the wings and has a red instead of yellow tip to its tail.

WAYCROSS, a city of southeastern Georgia, the county seat of Ware Co., situated about 10 mi. from the edge of the Okefenokee Swamp, 100 mi. southwest of Savannah. Three railroads afford transportation. The city is a shipping center for the products of the region: lumber, tobacco, cucumbers and watermelons. The manufactures are lumber, stoves, veneering, turpentine, artificial bee hives and canned fruits and vegetables. The retail trade in 1929 amounted to \$6,435,098. Waycross was founded in 1730 and in 1909 received a charter. Pop. 1920, 18,068; 1930, 15,510.

WAYFARING TREE (*Viburnum Lantana*), a handsome deciduous shrub of the honeysuckle family, native to Europe and western Asia and widely cultivated as an ornamental. It grows usually from 6 to 20 ft. high with scurfy branches, oblong heart-shaped, finely toothed leaves, deeply wrinkled above, numerous white flowers in showy flat-topped clusters and bright red fruit changing to black in late autumn. The shrub is sparingly naturalized in New England.

WAYNE, ANTHONY (1745-96), American soldier, was born at Easton, Pa., on Jan. 1, 1745. He was acquainted in youth with Benjamin Franklin, who aroused his interest in public affairs. In 1775 he raised and led a force of Pennsylvania troops for service in the Canadian campaign. In recognition of his skill, Wayne was made brigadier-general, and in 1777 joined Washington. He led a division at Brandywine, was in command of one flank at Germantown, and on July 15, 1779, he stormed Stony Point, N.Y., a feat which won him the soubriquet, "Mad Anthony Wayne." He retired from the army in 1784, and became a member of the Pennsylvania legislature. In 1792 he returned to the army as commander-in-chief. Wayne was successful in advances against the Indians, particularly at Fallen Timbers, and effected

the Treaty of Greenville on Aug. 3, 1795, in which the Indians consented to white colonization beyond the Ohio River. The Northwest was thus opened to civilization. Wayne died at Erie, Pa., on Dec. 15, 1796, while still holding the post of commander-in-chief of the army.

WAYNESBORO, a borough in Franklin Co., southern Pennsylvania, situated between Tuscarora and South mountains, 61 mi. southwest of Harrisburg. The Western Maryland and the Pennsylvania railroads and bus lines afford transportation. There is an airport. The surrounding region is rich farming country, producing chiefly apples, peaches and live stock. Waynesboro has many factories, the chief products being refrigerating machinery, mechanical tools, steam engines, sawmills, electric clocks, men's clothing and metal products. The retail trade in 1929 was valued at \$4,981,024. The borough is set in the beautiful Blue Ridge region, not far from Maryland. Nearby are interesting caverns. The village was laid out in 1797, made a borough in 1818. Pop. 1920, 9,720; 1930, 10,167.

WAYNESBORO, a city in Augusta Co., western Virginia, situated 12 mi. southeast of Staunton. It is served by bus lines and two railroads. There is an airport. Fruit, grain and live stock are raised in the vicinity. Iron, manganese and other minerals are found near by. The city has factories making silk, furniture, stoves and other products. Waynesboro was laid out in 1764 and named after "Mad" Anthony Wayne, who waged war with the Indians in this region. It was consolidated with Basic City in 1923. The city is the gateway to the beautiful Shenandoah National Park. The University of Virginia, Washington and Lee University and the Virginia Military Institute are easily reached from Waynesboro. Pop. 1920, 1,594; 1930, 6,226.

WAYS AND MEANS COMMITTEE, of the HOUSE OF REPRESENTATIVES is the revenue-raising committee charged particularly with the preparation of tariff legislation. Both parties (*see* DEMOCRATIC PARTY; REPUBLICAN PARTY) are represented on the committee in rough proportion to their strength in the House, but tariffs and other contentious partisan measures are prepared by the majority members in utmost secrecy. It is the only House committee that is accustomed to work on strictly partisan lines.

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WEAKFISH (*Cynoscion regalis*), called also squeteague, a marine food and game fish of the croaker family (*Sciaenidae*), found from Massachusetts Bay to the Gulf of Mexico. It is a slender, shapely fish, weighing usually about 5 lbs. In color it is dull brownish or olive-green above, marked with numerous small spots, and whitish below. Its flesh and mouth are very tender, whence its common name. The weakfish, which moves in schools, is a voracious feeder, subsisting chiefly on smaller fishes. Considered one of the finest of American food fishes, the weakfish is caught in large numbers in the middle

and south Atlantic states. The name is applied also to the closely allied spotted weakfish or squeteague (*C. nebulosus*), found from New York to Texas, and to the bastard weakfish or silver squeteague (*C. nothus*), of the Gulf of Mexico but straying northward to Maryland, both fine food fishes. In 1929 the catch of weakfish in United States waters was 33,765,999 lbs. valued at \$1,846,000. *See also* ANGLING.

WEALD, THE, a section in the southeastern part of England covering those parts of Kent, Surrey and Sussex enclosed within the North and South Downs. A small area in the center is densely forested. The rivers run through gaps in the downs and there are lagoons and marshlands.

WEALTH. The aim of economic activity is to produce a stream of utilities which afford a continuous flow of satisfactions or income. The stream of utilities or income is derived from a reservoir of things, forces, persons, knowledge and aptitudes, organization and relations, which collectively produce or afford utilities. A part, but only a part, of this reservoir or fund is wealth. It is conducive to clearness to define wealth, in the first instance, as the aggregate of material economic goods—scarce things that have utility. Material wealth, whether it is held as private property or is public wealth, like streets and parks, has value and, potentially at least, commands a price. Neither persons, unless they are slaves, nor their abilities are wealth. A man may command large INCOME by reason of his skill or knowledge, but skill and knowledge and other personal qualities are not wealth, except in a figurative sense. So with the accumulated knowledge and aptitudes of the race, they are sources of wealth but not wealth themselves. There are, however, some immaterial goods, or intangibles, which should be classed as wealth. A bond, mortgage, or share of stock is accounted part of the wealth of its owner, but strictly speaking it is only a claim to wealth. Organization, GOOD WILL or going-concern value, on the other hand, may be classed as wealth, both because they command a price and because without them the productivity and utility of material wealth would be much less than it is.

JOHN RUSKIN, incensed at what he regarded as the crass materialism of political economy, exclaimed "There is no wealth but life!" Figuratively, this is a true statement, but it involves a use of the term wealth which is unsuitable to the purposes of economic analysis. It would be more pointed to say "There is no income but living," but such a statement would not far advance our objective knowledge of economic processes. People commonly act, and economists sometimes write, as if wealth were an end in itself but that should not confuse us as to the real function of wealth, which is to embody and exude income. In economics, as in ethics, the person is end, and wealth is a means. If we could get the same income without the material paraphernalia of wealth, we should have no use for wealth; it would lose its function and cease to be wealth. Paradoxically, an ideal, were it possible, would be so to in-

crease the supply of economic goods that they would become free goods and therefore cease to be wealth. The only way we can measure wealth collectively is by its value or price. But the value or price of a good is not a perfect index of its utility. High value may be due to excessive scarcity, rather than to the utility of the good. The total value of all wealth might fall with an increase in the physical inventory of wealth, yet by that increase more human wants could be satisfied. *See also* ECONOMICS.

A. B. W.

WEALTH AND INCOME, DISTRIBUTION OF. *See* DISTRIBUTION OF WEALTH.

WEAPEMEOC, an extinct North American Indian tribe, probably belonging to the Algonkian linguistic stock. When first encountered by Sir Walter Raleigh and his colonists in 1584 they occupied the district north of Albemarle Sound in North Carolina. By the beginning of the 18th century they had been completely annihilated.

WEAPONS, PRIMITIVE. *See* PRIMITIVE WEAPONS.

WEARING APPAREL INDUSTRIES, UNITED STATES. This extensive group comprises establishments devoted to the manufacture of clothing, boots and shoes, hats and caps, millinery, knit goods, fur goods, and other articles of apparel, important statistics concerning which are given in the following table:

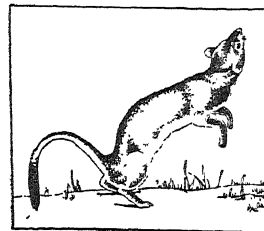
WEARING APPAREL MANUFACTURE, U.S., 1929

Item	No. Establishments	Wage Earners	Wages \$	Value of Products \$
Clothing, men's	4,234	188,361	206,730,078	1,040,128,192
Clothing, women's	8,082	187,500	243,851,143	1,709,580,505
Shirts	863	59,830	43,428,224	228,321,616
Collars	15	2,952	2,263,335	8,740,396
Furnishing goods, men's	598	26,588	23,009,391	150,963,603
Hats and caps	799	27,773	36,198,870	165,704,413
Millinery	1,293	32,206	42,715,059	195,693,457
Boots and shoes	1,341	205,640	222,407,732	965,922,694
Boots and shoes, rubber	22	25,659	29,945,265	102,537,625
Fur goods	2,855	15,752	33,329,965	277,592,752
Gloves, cloth	125	9,279	5,914,275	29,882,958
Gloves, leather	257	9,203	9,203,911	39,122,729
Knit goods	1,738	199,997	201,941,526	826,791,480
Corsets	213	13,664	12,446,334	76,802,199
Suspenders and garters	91	4,341	3,971,030	30,473,169
Handkerchiefs	105	6,014	4,635,901	29,553,777
Grand Total	22,631	1,014,759	1,121,992,039	5,877,806,565

WEASEL (*Mustela*), a small carnivorous mammal widely distributed throughout Europe, central and northern Asia and North America. Allied to the martens, it is one of the most savage and bloodthirsty of animals. The weasel has a slender body about 8 in. long, arched back, long flexible neck, short legs, a rather short tail and short, thick fur. The usual color is brown with white on the abdomen, but some weasels change their coat to all white in the winter. In its white pelage the weasel is sometimes called ermine.

The weasel makes a nest of leaves and grass in a bank or hollow tree. Here the female raises her five

or six young. Weasels live on birds, frogs, mice and even kill large rabbits. Individuals may become deadly enemies of henroosts, for one animal may slaughter a whole brood of small chickens, simply sucking the blood or eating the brains of the last victim and leaving the others untouched.



WHITE WEASEL OR STOAT

WEATHER, the instantaneous condition of the atmosphere, as contrasted to the average condition designated as CLIMATE. It includes an indication of the temperature, pressure and humidity of the air, of the cloudiness and sunshine, of the direction and velocity of the wind, of the amount of dust, haze, mist and fog, and the consequent visibility, of the presence or absence of precipitation of any kind and of the electrical condition. Observations on all of these aspects of the weather are carried out at a number of stations organized by a central Weather Bureau in each of the civilized countries of the globe.

The largest periodic variations in the weather, those of a seasonal nature, are due to the revolution of the earth around the sun, and find their main expression as a periodic rise and fall in temperature, with all its accompanying effects. The smaller varia-

tions are diurnal and due to the rotation of the earth on its axis, and the resulting rising and setting of the sun, and its consequent change in temperature, wind, humidity, etc. In the tropics, where the amount of solar heat changes but little during the year, the diurnal variation is often more pronounced than the seasonal one.

The large and important irregular variations, causing good and bad weather, storms, etc., are due to the inherent difference in climate existing between different regions on earth, on which are superimposed the seasonal and diurnal variations. The latter are allowed to accumulate for a short period of time until

a "trigger-effect" causes an upheaval and sets up the motion in the air that produces cyclones, storms, hurricanes and tornadoes. It is probable that the moon exerts some influence upon terrestrial weather, but such has not been clearly demonstrated as yet, and in any case must be very slight. In addition the solar activity as indicated by the number of sun-spots visible and subject to a periodicity of eleven years known as the sun-spot cycle, appears to exert a noticeable influence. In order to describe the weather concisely, an international system of notation, the Beaufort notation, has been introduced which designates every separate and salient aspect of the atmosphere by one letter. W. J. L.

WEATHERFORD, a city and the county seat in Parker Co., northern Texas; situated about 30 mi. west of Fort Worth. Bus lines and four railroads serve the city. The city is a railroad center and a distributing market for an agricultural district producing cotton, wheat, cattle, vegetables, watermelons and fruit. Weatherford was founded about 1858; incorporated in 1878. Pop. 1920, 6,203; 1930, 4,912.

WEATHERING, the decomposition of rocks and minerals effected by chemical agents and their disintegration by mechanical agents, in the atmosphere and surface waters of the earth. The forces are surficial, and a comparatively thin mantle of the debris they produce greatly hinders further activity. Only through the removal of this mantle by **EROSION**, can weathering eventually decompose and disintegrate great thicknesses of rock. The process is an important step in the great cycle of destruction and rebuilding of the earth's surface which is continually in progress. The mechanical processes involved are described under "Erosion." From the chemical standpoint the minerals of **IGNEOUS**, **METAMORPHIC** and **SEDIMENTARY** Rocks are unstable when exposed to the environments of air and circulating waters, so foreign to those in which they were formed. Oxygen combines with the iron and sulphur of rock and ore-forming minerals, changing their chemical composition. This is called oxidation. **MAGNETITE** and **PYRITE** are thus altered to limonite. Silicate minerals are decomposed through carbon dioxide combining with the bases and setting silica free. Water containing dissolved carbon dioxide is also a powerful solvent for many other substances. From both atmospheric and circulating waters, many minerals absorb moisture, becoming hydrated, a process often accompanied by expansion and disintegration. This phenomenon is important in the formation of **KAOLIN**, **BAUXITE** and **LATERITES** from **FELDSPAR**. Small amounts of ammonia in the atmosphere and the destructive effects of acids from organic material, roots of plants, animal excretions, and so on, also play their role in the decomposition of rock minerals.

Through these processes, rocks are converted into soil, which may remain in place, or be transported by running water, together with the substances taken up in solution, to be laid down as **DEPOSITS** elsewhere. See also **GEOCHEMISTRY**; **GEOLOGY**; **METAMORPHISM**;

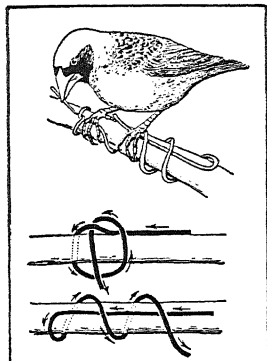
PETROLOGY; **SAND**; **CLAY**; **ORE DEPOSITS**; **SECONDARY ENRICHMENT**; **MINERALOGY**. S. F. K.

WEATHERING TESTS. See **TIME**, **EFFECT OF**. **WEATHER MAN**, usually a government employee whose function it is to predict weather conditions by means of meteorological data and research. See **METEOROLOGY**. An applicant is admitted to the service after passing an examination in physics, mathematics and other allied subjects, but he must have majored in them at some college to hold "professional" positions of high authority.

The weather man's duties are to gather and transmit weather information to newspapers, radio broadcasting stations, farm bureaus, shipping ports, and to air ports, which last are the most recent addition to the institutions depending upon his assistance. Care and exactitude, together with technical knowledge, are essential to success, for upon his calculations and prognostications are frequently based important movements involving considerable money. The opportunities for advancement are about the same as those of other important scientific positions which come under the regulations of the government Civil Service.

WEAVER, JAMES BAIRD (1833-1912), American political leader, was born in Dayton, Ohio, June 12, 1833. His parents moved to Michigan in 1835 and he later settled on a farm near Bloomfield, Ia. He attended the common schools and studied law at Bloomfield, 1853-56. He graduated from the Cincinnati Law School in 1856, was admitted to the Iowa bar the same year and began practice at Bloomfield. He enlisted as a private in the Second Regiment Iowa Volunteer Infantry in April, 1861 and was successively promoted to a first-lieutenant, May 27, 1861, major, July 25, 1862, colonel, Nov. 10, 1862 and to a brevet-brigadier-general of volunteers, March 13, 1864, "for gallant and meritorious services." He was elected district attorney for the second judicial district of Iowa in 1866 and served four years. Weaver was appointed by President A. JOHNSON, assessor of internal revenue for the first district of Iowa 1867-73. An opponent of the national policy of deflating the currency, he was one of the founders of the Greenback Party which elected him to the national House of Representatives in 1878. He was not a candidate in 1880, since that year he was the presidential nominee of the National Greenback Party, receiving about 350,000 popular votes. In 1884 as the coalition candidate of the Democratic and Greenback-Labor Parties, he was elected to Congress and reelected in 1886, serving March 4, 1885-March 3, 1889. He was defeated for reelection in 1888, and in 1892 was again a presidential nominee, this time as the candidate of the People's or Populist Party. Weaver polled the remarkably large vote for a minority party candidate of 22 electoral votes and more than a million popular votes. Weaver throughout his participation in national politics was a champion of agrarian interests. He was mayor of Colfax, Ia., 1901-03, and died in Des Moines, Ia., Feb. 6, 1912.

WEAVER BIRD, the name for a family (*Ploceidae*) of small finch-like birds remarkable for their skillful fabrication of huge, often pensile nests and for their social habits. The numerous species are found chiefly in Africa; a few, however, occur in

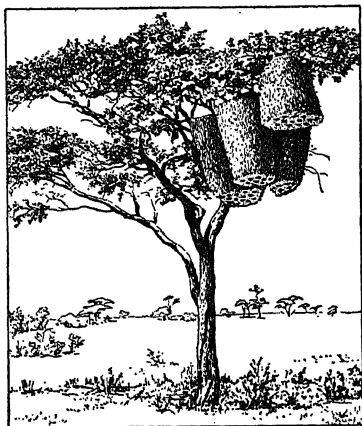


COURTESY AMER. MUS. OF NATL. HISTORY

KNOTS TIED BY A WEAVER BIRD (*Quelea quelea*)

southern Asia and one species has become acclimatized in the West Indies. They have stocky, sparrow-like bodies; stout, conical bills; wings with 10 primary feathers, and often conspicuous black, scarlet, crimson or golden-yellow plumage. Their food consists chiefly of seeds, including grain and occasionally of insects. Although possessing no real song, their cheerful chirpings are not displeasing, and some weaver birds are kept as cage birds.

The Baya weaver bird (*Ploceus baya*), common throughout India and Ceylon, suspends a beautiful purse-shaped nest, a foot long, from the tips of slender branches. The red-bellied weaver bird (*Textor niger*), with black plumage, a noisy, gregarious South African species common in Damara Land, breeds in colonies, constructing many collective nests in the same tree. Still more interesting is the social weaver bird (*Philetarus socius*), also of South Africa, which unites



COURTESY AMER. MUS. OF NATL. HISTORY

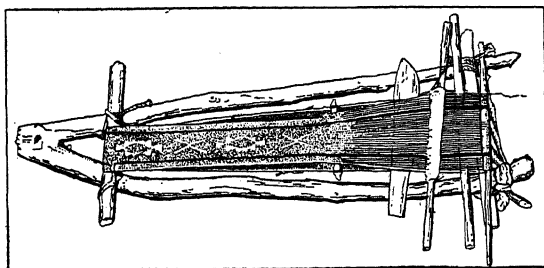
TREE NESTS OF WEAVER BIRD
Found in the Transvaal, South Africa

in colonies, sometimes of 200 or more, to build in the top of a carefully selected tree a huge dome-shaped roof, sometimes 12 ft. across. In the sheltered under surface of this roof each pair constructs a separate nest warmly lined with feathers. The so-called English sparrow or HOUSE SPARROW (*Passer domesticus*) introduced in 1851 and 1852 from Europe into America, where it is now the commonest bird, belongs to this family.

A. B. J.

WEAVING, the art of making cloth by interlacing two sets of yarns, one at right angles to the other. The warp yarns, which run the length of the cloth, are fed continuously to the loom from a large spool, known as the beam. In the simplest type of plain weaving every warp thread passes through an eye in the center of an individual vertical cord or wire, known as a heddle, there being one heddle for each thread. Every other warp thread passes through the heddles held in one frame, known as a harness (in silk weaving this is called a shaft and the group of shafts on a loom is known as the harness), and the remaining warp threads pass through the heddles of another frame. Alternately raising and lowering these harnesses a few inches, first one and then the other, lifts each set of warp threads in turn. The space between the upper and the lower sets of threads is known as the shed, and the operation of raising a harness to make the shed is called "shedding." Each time a new shed is made by a change in the positions of the harnesses, the shuttle is thrown through the shed, leaving behind a trail of filling thread (now rarely called weft thread in this country), the direction of motion of the shuttle reversing each time. After a thread has been laid in the shed, a metal comb, known as the reed, whose teeth pass between the warp threads, pushes the new filling thread against the last thread woven, in order that a tight texture will be produced. More complicated weaves are made by employing a larger number of harnesses and varying the order of warp threads in the upper and lower portions of the shed.

Three important types of loom vary in the control of the shedding. The more simple fabrics are woven generally on cam looms, the harnesses being raised by the action of suitably designed cams operating against levers. More complicated fabrics are woven on dobby



FROM P. E. GODDARD, INDIANS OF THE SOUTHWEST, COURTESY AMER. MUS. OF NATL. HISTORY

NAVAJO BELT LOOM

looms, in which the harnesses are raised in any order desired through the agency of pegs or rollers inserted in moving chains. The most elaborate designs are woven in jacquard looms, in which each warp thread has, so to speak, its own individual harness, each controlled by the presence or absence of a corresponding hole in a moving chain of cards.

All looms have at least one box or compartment at each side for holding the shuttle after it has completed its traverse of the cloth, but the so-called "box looms" have more than one box at one or both sides

of the loom, so controlled that any one of them may be placed in position to release the shuttle it contains or to receive the incoming shuttle. This makes possible the use of several shuttles, each containing filling yarn of different color, twist, or type. Pick-and-pick looms have more than one box on both sides and make unnecessary the laying of two consecutive filling threads by any one shuttle, because the shuttle in operation may be withdrawn at either side of the loom.

Although nearly all looms in use today are largely automatic, the term "automatic loom" applies only to the type which replenishes its filling thread automatically, relieving the weaver of the necessity for doing so.

E. D. F.

WEB, a continuous sheet of paper, usually wound in rolls. It comes from the paper machine in a roll that is sometimes as wide as 22 ft. Length is limited to the size of roll that can be conveniently handled. The paper mills slit the wide web and re-reel it in the widths desired, or cut it into sheets, according to commercial demands. The great rotary printing machines use paper in web form, cutting it into sheets after printing.

WEBB, SIDNEY (1859-), English statesman and writer, was born at London, July 13, 1859. He was educated in Switzerland and at the City of London College, and became a member of the bar in 1885. He belonged to the **FABIAN SOCIETY** and was prominent in the movement which established the British Labor Party. In 1922 he was elected to Parliament for Seaham Harbour, and was President of the Board of Trade 1922-23. In the MacDonald Cabinet of 1929 he was appointed Secretary for the Colonies and Dominions, and created 1st Baron Passfield. In 1892 he married Beatrice Potter who collaborated with him in writing and publishing his criticism of the English Poor Law policy. Among their joint works are: *English Poor Law Policy*, 1910, *Constitution for the Socialist Commonwealth of Great Britain*, 1920, and *Consumers Co-operative Movement*, 1921.

WEBB CITY, a city in Jasper Co., southwestern Missouri, situated 160 mi. south of Kansas City, and adjoining Cartersville. It is served by the Missouri Pacific and the Frisco railroads. Grain, fruit and Jersey cattle are raised in the vicinity. The city has machine shops, foundries, stock yards, flour mills and garment factories. Webb City was founded in 1873; incorporated in 1876. Pop. 1920, 7,807; 1930, 6,876.

WEBB-POMERENE ACT, of 1918, an act which permits American exporters to act in cooperation in export trade. Agitation for it was based primarily on the claim that European exporters enjoyed this privilege much to the disadvantage of American business. After exhaustive investigation the **FEDERAL TRADE COMMISSION** concluded that other nations had marked advantages because their nationals were permitted more effective organizations (combinations), and because American exporters were uncertain as to the degree of applicability of the antitrust policy to

them. As enacted, the Webb-Pomerene Act met this situation by authorizing the formation of export associations and by exempting them from the restraints of the **SHERMAN ANTITRUST ACT** and Section VII of the **CLAYTON ACT**. The associations are supervised by the Trade Commission and required to make reports to it. Unfair methods of competition are prohibited even when employed outside of the United States.

C. A. G.

WEBER, CARL MARIA FRIEDRICH ERNST (1786-1826), German music composer, was born at Eutin, Dec. 18, 1786. He is generally regarded as the first of the Romantic composers while his operas are an important link in the line of German operatic composition inaugurated by **GLUCK**. As a boy chorister he sang in the Salzburg Cathedral choir under Michael Haydn, the most eminent of his several music teachers. He began composing as a child and at the age of 13 completed his first opera extant, *Das Waldmädchen*. Through the influence of Abbé Georg Joseph Vogler he was appointed conductor of the Breslau Theater, remaining there two years; he then became capellmeister to Duke Eugene of Württemberg and Duke Ludwig of Stuttgart. In 1810, accused of having sold a court appointment insuring military exemption, he was imprisoned and, although his innocence was established, banished. Settling for a time in Darmstadt, he then proceeded on a concert tour, and in 1813 was appointed capellmeister of the National Theater in Prague, being called to Dresden in 1816 to reorganize the opera there and the following year being appointed conductor of the Royal Opera. There he commenced work on an opera that was to occupy him three years and become his *magnum opus*, *Der Frieschütz*. Its success was instantaneous and overwhelming, leading to a commission for another opera, *Euryanthe*. Although this proved less successful he was invited to London and offered \$5,000 for a third opera, *Oberon*, which the composer conducted himself at its première in 1826. Already weakened by consumption he lost ground with alarming rapidity and died only two months later, at London, on June 5, 1826. In addition to the operas cited he composed incidental to Wolff's *Preciosa*, two symphonies, two pianoforte concertos, six violin sonatas, and a number of short pianoforte solos.

WEBER, ERNST HEINRICH (1795-1878), German physiologist and anatomist, was born at Wittenberg, June 24, 1795. In 1818 he became professor of comparative anatomy at Leipzig, professor of human anatomy three years later, and professor of physiology in 1840. Weber was one of the founders of exact physiological study, particularly in his work on the mechanics of the human circulatory and reproductive systems. He was also one of the first to make careful investigations of the mechanics of nerve responses, laying the foundation of physiological psychology in his work on hearing and the sympathetic nervous system. Weber died at Leipzig, Jan. 26, 1878.

WEBER, MAX (1864-1920), German economist and sociologist, was born at Erfurt, Apr. 21, 1864.

He was professor of political economy successively at the universities of Freiburg, Heidelberg and Munich. His researches, mainly in social philosophy, influenced the development of modern political economy. He wrote *Geschichte der Handelsgesellschaften im Mittelalter*, 1889, *Wahlrecht und Demokratie in Deutschland*, 1907, and *Der Nationalstaat und die Protestantische Ethik*. Other works, including *Wirtschaft und Gesellschaft* and *Gesammelte Werke*, were published after his death, at Munich, June 14, 1920.

WEBER, WILHELM EDUARD (1804-1891), German physicist, was born at Wittenberg, Oct. 24, 1804. After studying at Halle and Göttingen universities, and successively serving as a professor of physics at both, he was a member of the faculty of the University of Leipzig during 1843-49, returning in 1849 to Göttingen. He worked chiefly in the fields of magnetism and wave theory, and in establishing and measuring electromagnetic units in terms of the standard units of length, mass and time. With K. F. Gauss he constructed a working model for an electromagnetic telegraph in 1833. He died at Göttingen, June 23, 1891.

WEBER OF FLUX. See MAGNETIC UNITS.

WEBER'S LAW, in psychology, states the relationship which an increased stimulus bears to the increased intensity of the sensation. Equal positive additions to sensation accompany equal relative additions to the stimulus. This has been worked out for the various senses and is found to vary with them. At the upper limits of sensation the law does not hold so accurately. Also it seems to vary somewhat with different individuals and at different times in the same individual. Nevertheless the ratio is accurate enough to have some significance. For further discussion of Weber's law see SENSATION and PSYCHOPHYSICS.

WEBSTER, DANIEL (1782-1852), American statesman and orator, was born at Salisbury (now Franklin), N.H., Jan. 18, 1782. After preparation for college by a minister and one term at Phillips Exeter Academy, he entered Dartmouth, graduating in 1801. His law studies were interrupted by a period as principal of a school at Fryeburg, Me., but in 1805 he was admitted to the bar in Boston, Mass. He practiced a short while at Boscawen, N.H., and in 1807 opened an office at Portsmouth, N.H. He combined an active interest in politics with his law practice and in 1812 as a Federalist he was elected to the national House of Representatives, serving from 1813-18.

In Congress Webster soon was recognized as an eloquent, forceful orator. Representing a district, which obtained its wealth from shipping, he expressed in Congress, the disapproval of his constituents of the War of 1812. He voted against a bill for chartering the second U.S. Bank, opposed high tariff and disapproved of what he considered the unwarranted exercise of power by the central government. Later Webster reversed his attitude toward these issues and explained his inconsistency on the

ground that the industrial nature of the region which he represented had been changed by national legislation and that his district desired a continuance of the type of legislation which had produced the change. Removal to Boston in 1816 resulted in the loss of his congressional seat after Mar. 4, 1817.

Until 1823, Webster engaged in law practice in Massachusetts courts and before the U.S. Supreme Court. Several of the cases in which he represented the successful litigants became famous as precedents for judicial interpretation of the Federal Constitution. Among these cases were the so-called Dartmouth College case (1818), in which the Supreme Court decided that no state could impair the obligation of contract; the *McCulloch vs. Maryland* case (1819), in which the court declared that the chartering of the U.S. Bank by the national government had been an exercise of the implied powers of the Constitution and that a state could not tax an instrument of the national government; and, the case of *Gibbons vs. Ogden* (1824) in which the court virtually incorporated Webster's arguments as counsel into the decision to the effect that no state might interfere with interstate commerce since its regulation had been delegated to the national government by the Constitution.

During these years Webster as an orator at public ceremonies gained a reputation as a speaker of rare talent. From 1823-27 he was a member of the national House of Representatives, and from 1827-41 he was a U.S. Senator. Originally a Federalist, he became a national Republican during the administration of John Quincy Adams (1825-29), and affiliated with the Whigs from 1833 until his death. An opponent of the tariff bills of 1816 and 1824 he signaled his changed attitude by supporting the high tariff of 1828. In 1830 he engaged in his famous debate with Robert Y. Hayne of South Carolina in which with occasionally beautiful language ornamenting his logical contentions, Webster asserted the necessary supremacy of the national government over the individual states and insisted that in the Supreme Court lay the sole power to judge of the constitutionality of Federal legislation. During the South Carolina Nullification episode (1832-33) Webster debated the question of states-rights with the masterful dialectician, John C. Calhoun. In all these tilts Webster was hailed by Northerners as having indisputably exposed the fallacies of the southern "compact theory" of government, but in the South his arguments were mostly regarded as unconvincing.

Webster received the electoral vote of Massachusetts for the Presidency in 1836 in a campaign with several Whig candidates and which was won by the Democrat, Martin Van Buren. In 1840 he declined to be the vice-presidential nominee of the Whig party on the ticket with William Henry Harrison, thus as events happened, losing the opportunity of being President. As Secretary of State, 1841-43, he satisfactorily adjusted several differences between the United States and Great Britain, including the north-

eastern boundary dispute which was settled by the Webster-Ashburton Treaty, 1843. He resigned from the cabinet in 1843 because of President Tyler's friendliness towards proposed annexation of Texas.

Once more, in 1845, Webster entered the Senate where he opposed Texan annexation and the Mexican War. After the Treaty of Guadalupe Hidalgo, 1848, he opposed any extension of slavery to the newly acquired territory. He became convinced, however, that the Union was threatened with dissolution and in his famous Seventh of March Speech (1850) he pleaded for compromise and the maintenance of the Union. His plea probably aided in the passage of the Compromise of 1850 but for his concessions to the pro-slavery faction he was denounced by anti-slavery extremists. After the death of President Zachary Taylor in 1850, the new President, Millard Fillmore, appointed Webster as Secretary of State. Aside from difficulties arising from filibustering expeditions to Cuba, Webster's second experience in the office contained no important events. He died at Marshfield, Mass., Oct. 24, 1852. S. McK.

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WEBSTER, JOHN (c. 1580 - c. 1625), Elizabethan dramatist, was born about 1580. Little of Webster is known more than that he was actor and literary hack for Philip Henslowe, the manager and playbroker. Something of his character may be deduced from his prefaces and dedications, in which he shows himself not too servile, contemptuous of the mob, and generous to his fellows. In his preface, 1612, to *The White Devil*, he reveals himself as fully conscious of his position as playwright, to be considered with Shakespeare and others. He began as joint playwright for Henslowe. The busy actor-authors sometimes divided their work considerably, and Webster was one of five who wrote *The Two Harpies*, 1602. In *Westward Ho!* he collaborated with Dekker, the latter probably writing the comedy. He assisted also in *Caesar's Fate*, and two plays on Lady Jane Grey in 1602. Three plays are considered Webster's own: *The White Devil*, probably 1611, *The Duchess of Malfi*, published in 1623, and *The Devil's Law Case*, 1619 or 1620, and *Appius and Virginia*, 1654. The first two show a tragic power equal in intensity to that of Shakespeare. Webster was a poor technician, however, and crowded his scene with detail and irrelevant action. He died about 1625.

WEBSTER, NOAH (1758-1843), American lexicographer, was born at Hartford, Conn., Oct. 16, 1758. He graduated at Yale and while teaching school at Goshen, N.Y., published in 1783 the *Webster Spelling Book* of which 60,000,000 copies were sold by 1889. For several years he practised law and wrote extensively on public affairs, but his crowning work was his *Dictionary of the English Language* in the preparation of which he spent 20 years. The first edition appeared in 1828 and the second in 1840. He died at New Haven, Conn., May 28, 1843.

WEBSTER, a town of Massachusetts, on the French, or Maanexit River, 16 mi. south of Worcester. It is served by the New Haven Railroad and motor buses. The manufactures include textiles, cottons, woolens, cutlery, paper, optical goods and shoes. In 1929 the value of the factory output was about \$6,000,000; the retail trade was valued at \$5,423,341. Webster was settled by Samuel Slater about 1800, one of whose cotton mills still stands. In 1832 the town was formed from parts of three other towns and named after DANIEL WEBSTER. Lake Chaubunagungamaug, covering 2 sq. mi., was a local Indian fishing place. Pop. 1920, 13,258; 1930, 12,992; 10% foreign-born.

WEBSTER-ASHBURTON TREATY, 1842, an agreement between the United States and Great Britain, defining the northeastern boundary of the United States. The dispute, consequent upon the ambiguous language of the TREATY OF PARIS, 1783, had been referred by the TREATY OF GHENT to a mixed commission for settlement; but the commission had failed to reach an agreement. In 1827 the dispute was referred for arbitration to the King of the Netherlands, but his proposal of a compromise line was satisfactory to neither side and rejected. In 1839 a temporary arrangement provided for joint occupation of the disputed territory by both parties. Lord Ashburton, appointed minister to the United States in 1841, negotiated with DANIEL WEBSTER, Secretary of State, devising a settlement giving about 7,000 of the 12,000 square miles of territory to the United States and stipulating that in consideration of the losses sustained by Maine and Massachusetts, the Federal Government should award these states \$300,000. Other provisions bound each nation to keep a squadron off the coast of Africa for the suppression of the slave trade, and established the mutual extradition of criminals. Though other differences between the two nations were ignored, the treaty recorded a great improvement in Anglo-American relations.

WEBSTER CITY, a city in northwestern central Iowa, the county seat of Hamilton Co., situated on the Boone River, about 65 mi. north of Des Moines. Bus lines and two railroads afford transportation. Corn and live stock are the chief products of the region. The chief manufactures are hog troughs and other farm equipment. Webster City is a horse and mule market. The Spirit Lake Relief Expedition was organized here in 1857. The city was founded in 1854. Dolliver Memorial State Park and Wall Lake State Park are in the vicinity. Pop. 1920, 5,657; 1930, 7,024.

WEBSTER GROVES, a city in St. Louis Co., eastern Missouri, situated 10 mi. southwest of St. Louis, of which it is a residential suburb. Two railroads afford transportation. The city is the seat of Eden Theological Seminary and of Webster College. In 1929 the retail business amounted to \$5,650,945. Webster Groves was incorporated as a city in 1896. Pop. 1920, 9,474; 1930, 16,487.

WEBWORM, a popular name for the larvæ of several species of small moths of the family *Pyradidae* and other families. On cabbage and related crops in the South one species spins webs in the leaves in late summer. The garden webworm works in spring on alfalfa, cotton and vegetables. In the West the sugar beet webworm is a serious pest on sugar beets. The southern beet webworm feeds on beets and spinach. Young corn and tobacco plants are attacked below ground by several species of corn root webworms especially on freshly turned old sod. All these species may be checked by fall plowing and thorough cultivation. Spraying with lead arsenate or paris green is effective for species above ground. The term webworm is also applied to the larvæ of larger moths (*Hipphantria*) of the family *Arctiidae*. These caterpillars are commonly known as fall webworms. Their large nests are often seen, enclosing branches of fruit or forest trees. In the North they occur in autumn. In the South there are two broods, one in summer and the other in the fall. Nests should be cut and burned when small. The fall webworm is distinct from the tent caterpillar, which appears in the early spring.

WEDEKIND, FRANK (1864-1918), German dramatist, was born at Hanover, July 24, 1864. His father was a physician. Wedekind studied law at Munich and Zurich, and after 1897 turned to writing plays in which he served as actor and producer, in collaboration with his wife. His drama involves symbolism and social and political satire. Political innuendos in his works caused his imprisonment for *lèse-majesté*. Examples of his drama are *Fruhlings Erwachen*, 1891, *Erdgeist*, 1895, *Die Buchse der Pandora*, 1903, *Franziska*, 1911. Wedekind also wrote poetry, novels and essays; his works were collected in eight volumes 1912-19. He died at Munich, Mar. 9, 1918.

WEDGWOOD, JOSIAH (1730-95), British potter, born at Burslem, Staffordshire, July 12, 1730. He was the youngest child of a family of potters, and, upon the death of his father in 1739, he left school and took his place at the potter's wheel. He became manager of a pottery works in 1752, after serving an eight-year apprenticeship to his brother. He opened a pottery of his own at Burslem in 1759 and developed a superior product in his cream-colored earthenware, a present of a set of this ware to Queen Charlotte in 1762 winning him royal patronage. His pottery quickly won unrivaled success, and he turned to more original work and the introduction of artistic products, the famous Wedgwood ware taking its decorative theme from newly discovered examples of classic Greek work; he employed skilled artists, among whom John Flaxman was the most famous. He formed a new partnership, and, in 1769, opened a new works, called Etruria. He was not only the most original but the most successful manufacturer in the history of pottery, and his influence upon its development has been incalculable. He also took much interest in welfare, social and educational work

in Staffordshire. One of his daughters married Dr. Robert Waring Darwin, and became the mother of the famous scientist. Wedgwood died at Etruria Hall, Jan. 3, 1795.

WEDMORE, TREATY OF (885), a treaty, settled at Chippenham, which divided England between Alfred the Great and the Northmen. Roughly a line was drawn between London and Chester. North of the line was conceded to the Danes. South of the line was held by Wessex. See ENGLAND.

WEED, THURLOW (1797-1882), American journalist, was born in Cairo, N.Y., Nov. 15, 1797. From a printer's apprentice at 14 he advanced through various journalistic ventures to owner and editor of the Albany *Evening Journal* in 1830. A power in public affairs, he was instrumental in selecting presidential candidates, and with Seward and Horace Greeley practically controlled the politics of New York State. He was sent to Europe during the Civil War on a diplomatic mission, and in 1867-78 published the *Commercial Advertiser*. Weed died in New York City, Nov. 22, 1882.

WEEDERS, machines for removing weeds from crops. They are used when the weeds are quite small and easily destroyed. The crop is usually cultivated blind, no attention being paid to the rows as the action of the weeder is not severe enough to damage the crop. The teeth of the weeder are long and flexible, working in a perpendicular position. As the tool is pulled along the teeth vibrate and mulch the surface soil, tearing out the small seedling weeds.

N. R. B.

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WEEDS, plants out of place or not wanted, and usually confined to cultivated land, or other place subject to interference by man, such as roadsides, embankments, railways, dooryards, and even in suburban streets.

Few native plants are ever weeds in their own country, and over 99% of North American weeds have been introduced from foreign regions. Europe and Asia have supplied hundreds, such as the wild mustard, garrow, dandelion, daisy, pigweed, the dock, purslane and plantain.

Some native American plants have become pernicious weeds abroad, notably various cactuses of the prickly pear type. In northern Africa and parts of Australia these are now a serious problem, just as the wild mustard is in our own grain fields.

Because they tolerate the disturbed conditions of cultivated land, and often seed very freely, weeds are an economic factor of first importance. Many states, and some foreign countries, have enacted weed legislation, designed to eradicate the worst pests. And some weeds, like the orange hawkweed and the dandelion have such beautiful flowers that they are commonly picked as wild flowers.

Weeds do most damage only to cultivated crops, the food supply of which they curtail. When thick enough, they even appropriate nearly all the light and air. Otherwise they form a motley and often pic-

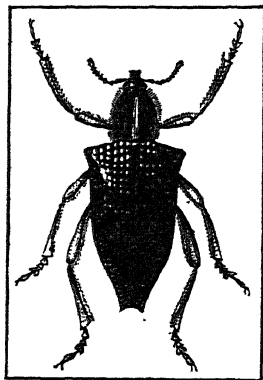
turesque element of our fields and roadsides, over 600 species being known in eastern North America.

N. T.

WEEHAWKEN, a township of northeastern New Jersey, in Hudson Co., situated on the Hudson River about 4 mi. northeast of Jersey City. Weehawken was at one time a well-known dueling ground, and it was here that ALEXANDER HAMILTON and AARON BURR met in the famous encounter in 1804 which resulted in the death of Hamilton. Pop. 1920, 14,485; 1930, 14,807.

WEEMS, MASON LOCKE (1760-1825), American clergyman, was born in Maryland in 1760, and educated for the Anglican ministry in London. On returning to America he found it impossible to receive ordination, as the Protestant Episcopal Church was not yet organized in the United States. He preached however in various pulpits and in 1800 published a popular *Life of Washington* which by 1891 had gone into 70 editions. It contained much fictitious matter, including the cherry-tree anecdote. Weems died in Beaufort, S.C., May 23, 1825.

WEEVIL, a popular name for many species of snout beetles (series *Rhyncophora*) and their larvæ. The group includes some of the worst pests which man has to fight. Both adults and larvæ do damage.



DIAMOND WEEVIL
Entimus imperialis

As the latter generally feed in concealment within the tissues or beneath the ground on roots, or at night, their presence is often unsuspected until they have wrought serious havoc.

Beans, corn, peas, wheat, cowpeas, barley, rice and other stored seeds and their products are often destroyed or rendered unfit for planting or human food by several different species. These may be destroyed by fumigating with carbon-disulphide or carbon-tetrachloride or by heating the grain to 130 or 140°, for three or more hours. In homes when foodstuffs are infested, first thoroughly clean the storage quarters. Then saturate all cracks in walls with gasoline. Finally fumigate the quarters and the foodstuffs if possible.

Alfalfa and clover, more specially in old fields, are sometimes destroyed by larvæ which eat the leaves. The best control is to plow the fields and rotate crops for a few years. Crops of strawberries are often reduced through the destruction of the flower buds by one species. As attacks are worst in old plantations this pest may be kept in check by plowing immediately after harvest to bury the larvæ. Rose plants in greenhouses are injured by one species whose larvæ destroy roots. Fertilizing liberally with powdered tobacco or soaking the soil periodically with tobacco extract will destroy them. The adults may

be killed by spraying with arsenate of lead or paris green. Nuts of pecan, hickory and chestnut are often made wormy by three species. Direct control by spraying is not feasible as the trees are large; the adults appear irregularly throughout summer and the larvæ hatch inside the young nuts. Gathering and fumigating the nuts will destroy the larvæ and thus leave only those missed to reproduce the species.

Rhubarb leaves and stems are eaten by both adults and larvæ of another species. These may be kept in check by regular cutting of the leaves, burning the unmarketable parts and all old leaves not needed by the plants until about midsummer. Dock plants should also be destroyed as the insects feed on them.

M. G. K.

WEICHSEL RIVER. See VISTULA.

WEIGELA, a name applied to various Asiatic species allied to the BUSH HONEYSUCKLE (*Diervilla*) of the United States several of which, including numerous varieties and hybrids, are extensively cultivated as ornamentals. They are mostly free flowering shrubs, 2 to 10 ft. high, with opposite, toothed leaves, yellowish-white, pink or crimson flowers in axillary or terminal clusters and slender, two-valved fruiting capsules containing numerous minute seeds. Although most weigelas flower profusely in late spring and at the beginning of summer, there are several hybrids which bloom very early.

WEIGHING MACHINES, mechanisms for determining the quantity, by mass, of a substance. The most common weighing device or *scale* operates on the LEVER and BALANCE principle. That is, the load is balanced by a small known weight which has a large mechanical advantage, say 100 to 1, by virtue of a system of levers. With the ratio mentioned, a balance obtained with, say, a five-pound weight, would mean that the load on the scales was 500 pounds. By a beam and sliding weight arrangement, small variations in the mechanical advantage are obtained to give accurate weighing in fractions of the least *known* weight. Such a scale is known as the *platform* type and is used in weighing heavy loads, as cars, cattle, grain and coal.

Weighing machines used on counters, as in grocery stores, usually have a pendulum balance, or a pair of such balances, which are swung away from the vertical by any depression on the weighing pan through an arrangement of cams and levers. The resisting force of these pendulums increases as the angle which they make with the vertical increases according to the relation $\frac{\sin \theta}{\cos \phi}$, where θ is the angle

between the pendulum and the vertical and ϕ the angle between it and the horizontal. Thus, the pendulum swings out until a balance is reached with the load. An indicating dial and pointer give the weight.

Another type of weighing machine utilizes springs as the balancing mechanism, the force which the springs exert depending upon the extent of their distortion from their no-load position. The position under load is communicated through a pointer and

indicating dial to give the weight. Spring scales are usually not as accurate as the lever-and-balance or pendulum types.

In all scales the various beams and levers are mounted on knife-edge fulcrums to secure accuracy by eliminating friction.

In industry, scales are usually classified according to their particular adaptations. *Computing* scales are automatic self-indicating counter scales which are calibrated to indicate not only the weight of the goods, but their monetary value. Automatic feed scales are a combination of hoppers and scales which catch an intermittently fed commodity, such as grain, and automatically dump when a predetermined weight of the commodity has been collected in the hopper; by means of a counting device or recorder the total weight of the commodity that has passed through the scales can be obtained. *Conveyor* weighers comprise a set of rollers, attached to a weighing machine, over which passes a continuous belt carrying a load. The scales are connected to a device that measures the velocity of the belt so that a product of weight and velocity, or the total quantity passing over the belt, is obtained. Totalizers are automatic-balancing scales which weigh and record the total of the weights of a series of individual loads, as a row of crates, which pass over the platform. Weighing counters are lever-and-balance scales with a definite load-balance ratio; as 100 to 1; they are used to count such objects as bolts, one bolt being used as the balancing weight so that the number of bolts in the pan will be known from the ratio when a balance is reached.

WEIGHTING, in textile manufacturing, the process of applying suitable materials to increase the weight of the yarn or fabric beyond that of the fibers themselves. Weighting is made use of chiefly in the case of silk. The most common method of weighting silk is to treat the material successively with solutions of sodium silicate, stannic chloride, and disodium phosphate. This process is known as tin weighting. One treatment adds up to 25% of weight to the silk, and repeated treatments give higher percentages. Excessive loading is liable to cause damage to the silk, but a reasonable percentage of weighting enhances the appearance and handle of the silk and is not considered harmful. Tin-weighted silk may be left white or may be dyed with any of a wide range of colors.

Silk which is to be dyed black, is often weighted with tannin and an iron salt in place of tin. The silk after having been thus weighted is dyed with logwood.

Fabrics containing rayon and other synthetic fibers occasionally are weighted with chemicals in somewhat the same manner as is silk.

Weighting of cotton is usually considered as part of the finishing operation; magnesium sulphate, talc, China clay and gypsum are among the materials most commonly employed.

W. W. C.

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WEIGHTS AND MEASURES. Means of comparing weights, capacities and volumes have been necessary in all the constructive work of man and in his commercial relations since the earliest times. With the development of the sciences, accurate standards of weights and measures have been necessitated, and with the development of commercial relations between communities, states and nations, need for uniform state and international standards has been experienced.

The problem of establishing prototypes that will not deteriorate or alter in dimension and weight with age, handling and temperature changes has been a difficult one. It has been satisfactorily solved in the prototypes of platinum-iridium. The problem of securing uniform standards has been even more difficult. Each important nation has more or less uniformity in its standards, but world-wide adoption of an international standard is yet to be accomplished. The METRIC SYSTEM and the work of the INTERNATIONAL BUREAU OF WEIGHTS AND MEASURES, in providing the various countries with prototypes of the international meter and kilogram, is doing much toward international uniformity in weights and measures.

The customary system of England is the imperial, based upon the yard of 36 inches, the commercial pound avoirdupois of 7,000 grains, the pound troy of 5,760 grains and the gallon of 10 pounds avoirdupois of distilled water at 62° F. The UNITED STATES WEIGHTS AND MEASURES correspond to the imperial except for the units of capacity. Tables of the weights and measures of the United States and Great Britain are given below.

TABLE OF WEIGHTS AND MEASURES

LINEAR MEASURE

12 inches (in.)	= 1 foot (ft.) = 0.3048 m.
3 feet	= 1 yard (yd.) = 0.914402 m.
5½ yards	= 1 rod (rd.), pole (p.) or perch (p.) = 16½ ft.
40 rods	= 1 furlong (fur.) = 220 yds.
8 furlongs	= 1 mile (mi.) = 5,280 ft. = 1,609.3 m.
3 miles	= 1 league (l.) = 15,840 ft.
3 inches	= 1 hand
9 inches	= 1 span

NAUTICAL UNITS

6 feet	= 1 fathom
100 or 120 fathoms	= 1 cable-length
6,080.27 feet	= 1 nautical mile = 1.85325 km.
1 nautical mile per hour	= 1 knot

The official British nautical mile is 6,080 feet.

SURVEYOR'S MEASURE

7.92 inches (in.)	= 1 link (li.)
100 links = 4 rods = 66 ft.	= 1 Gunter's or surveyors' chain (ch.)
80 chains	= 1 mile (mi.)
also	
12 inches	= 1 link (li.)
100 links	= 1 engineers' chain (ch.)

WEIGHTS AND MEASURES

MEASURES OF AREA

144	square inches (sq. in.)	= 1 square foot (sq. ft.) =	929.03 sq. cm.
9	square feet	= 1 square yard (sq. yd.)	
30 $\frac{1}{4}$	square yards	= 1 square rod (sq. rd.)	
160	square rods	= 1 acre (a.) = 4,046.87 sq. m.	
640	acres	= 1 square mile (sq. mi.) =	1 section
1	circular inch	= 0.7854 square inch (area of a circle 1 inch in diameter)	
1	square inch	= 1.2732 circular inches	
1	circular mil	= area of circle 0.001 inch in diameter	

MEASURES OF VOLUME

1,728	cubic inches (cu. in.)	= 1 cubic foot (cu. ft.) =	28.317 cu. cm.
27	cubic feet	= 1 cubic yard (cu. yd.)	
128	cubic feet	= 1 cord (cd.)	

LIQUID OR FLUID MEASURE

4	gills (gi.)	= 1 pint (pt.)	
2	pints	= 1 quart (qt.)	
4	quarts	= 1 gallon (gal.) = 231 cu. in.	
31 $\frac{1}{2}$	gallons	= 1 barrel (bbl.)	
63	gallons	= 1 hogshead (hhd.)	
2	hogsheads	= 1 pipe or butt	
2	pipes	= 1 tun	

The British imperial gallon is 277.274 cu. in. and the other capacity units are of corresponding value.

DRY MEASURE

2	pints (pt.)	= 1 quart (qt.)	
4	quarts	= 1 gallon (gal.) = 1.164 liquid gals.	
2	gallons	= 1 peck (pk.)	
4	pecks	= 1 bushel (bu.) = 2,150.42 cu. in.	

The British imperial bushel is 2,218.192 cu. in. and the other units have a corresponding value.

APOTHECARIES' MEASURE

60	minims (℥)	= 1 fluid dram (f℥)	
8	fluid drams	= 1 fluid ounce (f℥)	
16	fluid ounces	= 1 pint (O.)	
8	pints	= 1 gallon (Cong. or C.) = 231 cu. in.	

AVOIRDUPOIS, OR COMMERCIAL, WEIGHT

27.34375	grains (gr.)	= 1 dram (dr.)	
16	drams	= 1 ounce (oz.) = 437.5 grains =	0.911458 oz. troy
16	ounces	= 1 pound (lb.) = 7,000 grains =	453.6 grams
100	pounds	= 1 hundredweight (cwt.)	
2,000	pounds	= 1 short ton or ton (t.)	
2,240	pounds	= 1 long ton	

IN GREAT BRITAIN

14	pounds	= 1 stone	
2	stone	= 1 quarter = 28 lbs.	
4	quarters	= 1 hundredweight (cwt.) = 112 lbs.	
20	hundredweight	= 1 long ton = 2,240 lbs.	

TROY WEIGHT

24	grains (gr.)	= 1 pennyweight (pwt. or dwt.)	
20	pennyweights	= 1 ounce (oz.) = 480 grains =	1.09714 oz. avoird.
12	ounces	= 1 pound (lb.) = 5,760 grains	

APOTHECARIES' WEIGHT

20	grains (gr.)	= 1 scruple (℥)	
3	scruples	= 1 dram (℥)	
8	drams	= 1 ounce (℥) = 1 oz. troy	
12	ounces	= 1 pound (lb.) = 5,760 grains	

DIAMOND WEIGHT

16	parts	= 1 jewelers' grain	
4	jewelers' grains	= 1 carat = 3.2 grains troy	

CIRCULAR MEASURE

60	seconds (")	= 1 minute (')	
60	minutes	= 1 degree (°)	
90	degrees	= 1 quadrant or right angle	
360	degrees	= 1 circumference or circle	

A radian, or unit of angular measure, is an angle at the center of a circle subtended by an arc of the circumference equal in length to the radius. It is equal to 57.2958 degrees.

BOARD MEASURE

1	board foot (bd. ft.)	= 144 cubic inches = volume of board	
		1 ft. square and 1 in. thick	

TIME MEASURE

60	seconds (sec.)	= 1 minute (min.)	
60	minutes	= 1 hour (hr.)	
24	hours	= 1 day (d.)	
7	days	= 1 week (wk.)	
4	weeks	= 1 month (mo.) = 28, 29, 30 or 31 days	
12	months	= 1 year (yr.) = 365 or 366 days	
100	years	= 1 century (c. or cent.)	

PAPER MEASURE

24 (or 25)	sheets	= 1 quire	
20	quires	= 1 ream = 480 or, usually, 500 sheets	
21 $\frac{1}{2}$	quires	= 1 printers' ream = 516 sheets	
2	reams	= 1 bundle	
5	bundles	= 1 bale	

U. S. MONEY

10	mills	= 1 cent (c. or ct.)	
10	cents	= 1 dime (silver coin)	
10	dimes	= 1 dollar (d., dol., or \$)	
10	dollars	= 1 eagle (gold coin)	
20	dollars	= 1 double-eagle (gold coin)	

BRITISH MONEY

4	farthings	= 1 penny (d.)	
12	pence	= 1 shilling (s.)	
20	shillings	= 1 pound sterling (£)	
21	shillings	= 1 guinea	

COUNTING

2	things	= 1 pair	
12	things	= 1 dozen	
20	things	= 1 score	
12	dozen	= 1 gross = 144 things	
12	gross	= 1 great gross = 1,728 things	

WEIGHTS AND MEASURES, ANCIENT. The history of weights and measures dates from the time when man first began to employ his ingenuity in creative work or construction, and the first attempts at standardization or uniformity in weights and measures came with the inception of commercial exchange. The first units were those which nature provided.

Measures of length were taken from the length of the arms, the width of the hand, the length of the finger, the distance around the waist, the length of the body or legs and the length of the foot and the pace. The first measures of volume were the heap or pile and the capacity of certain shells. The first units of weight were the grains or kernels of various plants.

The CUBIT, the oldest of the units of length, dates from early Biblical times. It is known to have been used by the Babylonians and the Egyptians, the latter having three cubits of about 17, 21 and 35 in., respectively, termed the cubit of man, of king and of the sanctuary. Archaeologists have found a stone weight, roughly corresponding to a POUND avoirdupois, which is believed to be the standard of weight of an ancient Babylonian king.

The ancient units of weight and measure used by the Egyptians were the basis from which those of the Greeks and Hebrews were derived. In Israel the following units were used: liquid measure, the homer, corresponding to a HOGSHEAD, = 10 baths = 60 hins = 720 logs; dry measure, homer = 10 ephah or 3 shea = 100 omer; in weight and coins, shekel = 20 gerahs, maneh = 60 shekels, talent = 3,000 shekels. The ephah was formed by cubing an Egyptian unit of length, the ardab; the shekel was equivalent to about $\frac{1}{2}$ oz. avoirdupois.

In ancient Greece the cubit was again used, but at the beginning of the Olympic Games the foot of Hercules is supposed to have been taken as the unit of length, replacing the cubit. A measure of 600 of these feet comprised the stadium, the length of the course or stand, and this became the Greek standard of long linear measure. The Greeks had weights corresponding to the pound, troy and avoirdupois, and for moneys they used the talent, mina and drachma. Their measures of capacity for grain and water were calculated from the cube of a measure of length, but those for wine and oil were on a weight basis.

The Romans took their weights and measures from those of the Greeks. Their unit of quantity was the pound, or libra, of which they had two, one for weight and the other for capacity. Three centuries before the Christian era the Roman measures of capacity included a quadrantal, containing 80 lbs. of wine, and a conigus, containing 10 lbs. wine and comprising 6 sextarius.

At the time of their conquest of Britain, the Romans forced their system of weights and measures upon the people of England, but most of the units were altered after the cessation of Roman influence. The English yard, the measure derived from the circumference of the body, corresponded to the Roman ulna or ell, but it lost its original meaning and became the length of the arm of Henry I. The yard became the multiple of the foot, and the inch was taken as the length of three barley-corns. By provisions in the statutes of Henry III, 1266, wheat grains were made the fundamental standard of weight and the following system declared legal: 32 grains = 1 silver penny, 20 pence = 1 oz., 12 oz. = 1 lb., 8 lbs. = 1 wine gal., 8 wine

gals., by weight, = 1 bu. The pound of this system, known as the Tower pound, was used for the mint until replaced by the pound troy in 1527, when it comprised 5,400 grains troy. Along with the Tower pound, a pound of 15 oz., 6,750 troy grains, was used for commercial purposes. By this system, the wine gallon contained 216 cu. in. or $\frac{1}{8}$ cu. ft., corresponding to the Roman conigus. Other measures existing at this time were the ton of shipping containing 32 cu. ft., or 2,018 lbs. of 15 oz.; a ton of wine of 252 gals.; a pipe of 126 gals.; a hogshead of 63 gals.; and a barrel of herring or eels of 30 gals.

In the next two centuries, with the influx of merchants from continental Europe, new measures were introduced in England and several changes took place. The goldsmiths and bankers introduced the troy system, of French origin, with the pound of 5,760 grains and 12 oz. With this came the corresponding commercial pound of 7,000 grains and 16 oz., probably of Norman origin, and later the avoirdupois pound.

In 1494 Henry VII had copies of the standards of weights and measures made for the principal cities. These were found to be deficient, and, to correct the evil, a statute was passed in 1496 with the intention of reinstating the weights and measures of 1266. In this statute two errors arose: the old penny sterling was erroneously taken as being the pennyweight troy and the old bushel was considered to be the measure of volume of 8 gals. of wine instead of a measure of substance corresponding to the weight of 8 gals. of wine. The latter mistake caused the measures of capacity to be entirely different from the old standards. Other measures had also been derived from the ton of 32 cu. ft., so that the final result was a diversified system of measures for capacity with several different gallons and bushels. This was ultimately remedied by the introduction of the imperial system of weights and measures in 1824. In 1527 the troy pound became the standard for money and medicines and in 1532 the avoirdupois pound of 7,000 grains was made the commercial standard. The merchant's pound of 7,200 grains, which had been in use, disappeared with the new standards. In 1824 the troy pound was established as the standard weight of the imperial system, but was superseded for everything, except gold, silver and medicines, by the avoirdupois pound in 1834.

The UNITED STATES WEIGHTS AND MEASURES were derived from those prevalent in England during the period of colonization. *See also* WEIGHTS AND MEASURES; METRIC SYSTEM.

WEIGHTS AND MEASURES, APOTHECARIES'. *See* APOTHECARIES' WEIGHTS AND MEASURES.

WEIGHTS AND MEASURES, INTERNATIONAL BUREAU OF. *See* INTERNATIONAL BUREAU OF WEIGHTS AND MEASURES.

WEIGHTS AND MEASURES, UNITED STATES. The system of weights and measures used in this country has been derived from the old English standards. The common units of length and weight are identical with the present British imperial stand-

ards, but units of capacity differ from those in England. The colonists introduced measures of weight, length and capacity patterned after the prototypes in the exchequer at London which had been legalized by statute in 1601. These included the yard of three feet, the pound avoirdupois of 7,000 grains and 16 oz., the pound troy of 5,760 grains and 12 oz. and a system of capacity measures with several units of varying values. There were several standard bushels of eight gallons, and the gallons of each varied according to the substance for which it was used. Thus, there was a wine gallon of 219½ cu. in., one of 217.6 cu. in., one of 231 cu. in. and another of 224 cu. in. For each of these wine gallons there were corresponding ale, beer and corn gallons.

With all these standard capacity measures to choose from, it is only natural that the colonies, and, later, the states, should have different capacity standards. Congress itself has never legally adopted a system of weights and measures for the country at large, the legislation providing for uniformity in standards having all been executed by the states. In 1832, however, it sanctioned the issuance, by the Treasury Department, of prototypes of the yard, the pound avoirdupois, the wine gallon of 231 cu. in. and the Winchester bushel of 2150.42 cu. in. to the respective states, and thereby indirectly approved those standards for national use.

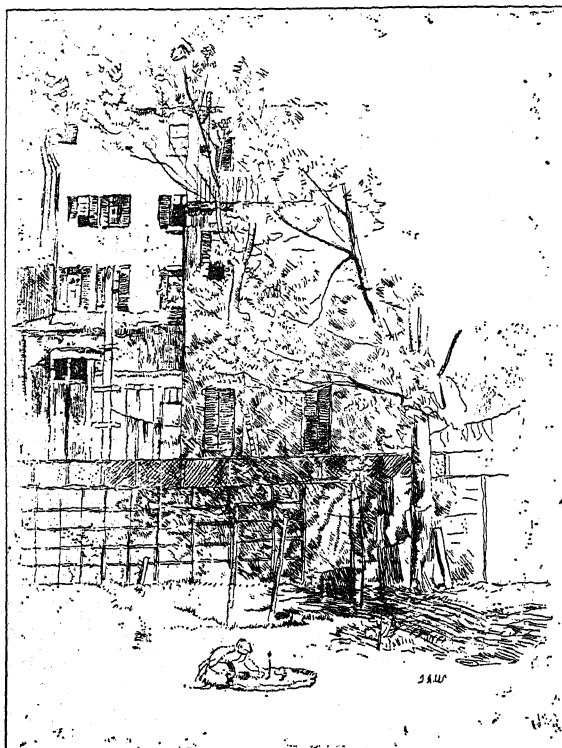
In 1866, Congress legalized the use of the METRIC SYSTEM and obtained prototypes of the meter and kilogram from the INTERNATIONAL BUREAU OF WEIGHTS AND MEASURES. In 1891, the Office of Weights and Measures, now the Bureau of Standards, made the international meter and kilogram the basis of the yard and the pound, which are accordingly defined in terms of metric units: one yard = 3,600/3,937 meters and one pound = 453.59243 grams. The troy pound came into use for money, jewels and medicines along with the avoirdupois pound and in the same ratio to it that it had borne in England, viz. 5,760/7,000.

Because of the unwieldiness of the present system of weights and measures, there has been considerable agitation for a change to a decimal system, such as the metric system. *See also* WEIGHTS AND MEASURES.

WEIHAIWEI, a small area on the northern side of the Shantung Peninsula of China comprising an area of 285 sq. mi. including the island of Liukung; held under lease by the British from 1898 to 1930. Britain secured a leasehold to Weihaiwei in order to have a naval base in North China waters to counteract Russian expansion in Manchuria. The port was used by the British navy in the Far East as a summer station. Negotiations for the return of the leasehold to China went on for a number of years. An agreement finally was reached in 1929, and the transfer was made the following year. Fishing and farming are the principal occupations of the people. The port is especially significant as a trade center, although farm and sea products are exported to a certain extent. Pop., of the leased area, 1929, approximately 155,000.

WEIMAR, a German city, capital of the German state of Thuringia, formerly of the grand duchy of Saxe-Weimar-Eisenach situated about 60 mi. southwest of Leipzig. The foremost building is the grand-ducal palace, parts of which are dedicated to Wieland, Goethe, Herder and Schiller, with frescoes illustrating their works. In front stretches the charming park to the River Ilm, beyond which is Goethe's garden house. Lucas Cranach's house, the Goethe and Schiller Museum in Goethe's house, Schiller's, Herder's and Wieland's homes, Liszt's villa and the National Goethe Museum are noteworthy. There are many fine statues, among them those of Goethe and Schiller in front of the new theater built in 1907, which replaced the old Court Theater once under the direction of Goethe and Schiller. In the grand-ducal mortuary chapel near the casket of Karl August are the bronze coffins of Goethe and Schiller. Of all the Weimar rulers of various illustrious dynasties since early times, Karl August's reign is the most memorable. That able prince called to his capital such men as Goethe and Schiller, making Weimar the center of German intellectual life. Pop. 1925, 45,957.

WEIR, JULIAN ALDEN (1852-1919), American painter and etcher, was born at West Point, N.Y.,



COURTESY METROPOLITAN MUSEUM OF ART

MY BACK YARD

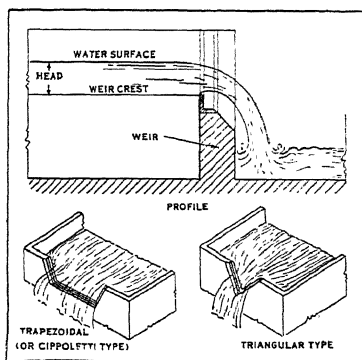
An etching by Julian Alden Weir (1852-1919)

Aug. 30, 1852. He studied under his father, Robert Weir, and with Gérôme in Paris, becoming an exquisite painter of flowers and a bold, original etcher. President Wilson chose him for the National Com-

mission of Fine Arts in 1916. He was president of the National Academy of Design in 1915, and an original member of the "Ten American Painters." He is represented in the Corcoran Art Gallery, Washington, by *Autumn* and a portrait, *Miss De L.*; and in the Metropolitan Museum, New York, by *Idle Hours*, *The Green Bodice*, and *The Red Bridge*. Other paintings hang in the Luxembourg, Paris, and in many galleries in the United States. Weir died in New York City, Dec. 9, 1919.

WEIRS, in river improvement, submerged, artificial obstructions in a stream to raise the water level or divert water. See RIVER IMPROVEMENT; DAMS; BARRAGE. Also a device for measuring the discharge, or volume of flow, of water.

Standard *measuring weirs* consist of a thin submerged partition or dam over which flows the water



MEASURING WEIRS

to be measured. The opening for the water is usually rectangular; trapezoidal, as in the "Cippolletti" weir; or V-shaped, as in the "triangular" weir. Weirs are calibrated according to dimensions and by hydraulic formulae so that the depth or head of water over or through the weir will indicate the volume of water discharged through the weir in a given unit of time.

See M. Merriman, *Elements of Hydraulics*, 1912.

WEISMANN, AUGUST (1834-1914), German zoölogist, was born in Frankfurt-on-Main, Jan. 17, 1834. He received his degree in medicine at Göttingen, studied at Rostock, and practiced medicine at Frankfurt until 1863 when he turned to the study of zoölogy at Giessen. From 1866 until 1912 he was professor of zoölogy at Freiburg, Breisgau. His early important investigations dealt with the embryology of many of the arcanidae. Defective eyesight forced him to abandon the microscope and he turned to the philosophical aspects of biology. His studies of problems of evolution led him to adopt the theory of the continuity of the germ plasm, first proposed by Jäger, as the sound explanation of animal descent. His theory, Weismannism, sought to account for evolutionary change in species solely by factors inherent in the germ plasm, denying at once Lamarckian inheritance (see LAMARCK) of acquired characteristics, and the environmental factors admitted by the Dar-

winians. Although his theories met certain scientific objections they were widely received and exercised great influence. He is the author of *Studies in the Theory of Descent*, *The Evolution Theory*, and *Essays upon Heredity and Kindred Biological Problems*. Weismann died at Freiburg, Nov. 5, 1914.

WEISSENFELS, a German city in the Prussian province of Saxony, built on both banks of the River Saale. It was the capital of the dukes of Saxony-Weissenfels, a line of the House of Wettin, from 1656 to 1746. In 1814 it fell to Prussia. On a hill is the Neu-Augustusberg Castle, a Baroque building erected between 1664 and 1690. Under the chapel several princes and the viscera of Gustav Adolph are buried. Other interesting buildings are St. Mary's Church, with a fine tower, built in 1300, and the nunnery of the order of St. Clare with splendid gardens and cloisters. Weissenfels has important shoe factories and also produces paper, shoe machines, chains, sugar and fur and rubber goods. The trade is chiefly in leather, grain and cattle. Pop. 1925, 36,756.

WEISSHORN MOUNTAIN, in Switzerland, is one of the highest elevations of the ALPS in the Pennine group. It is situated in the canton of Valais, between Nicklausthal and Val d'Anniviers; Zermatt lies 5 mi. to the southeast. It is a beautiful and symmetrical peak, considered by many the most magnificent of the Alps. Rising west of the Zermatt Valley, it towers to a height of 14,803 ft. The English physicist Tyndall made the first ascent in 1861.

WEITSPEKAN, a North American Indian linguistic stock comprising a single tribe, the YUROK. They lived in the lower Klamath River valley and on the near-by coast of northern California.

WEIZMANN, CHAIM (1874-), Russian chemist and Zionist leader, was born in Motol, Province of Grodno, Nov. 27, 1874. He was educated at Pinsk, and at the universities of Berlin and Freiburg. He became a lecturer in chemistry at the University of Geneva, and later feawef iu biochemistry at the University of Manchester. From 1916 to 1919 Weizmann was director of the Admiralty Laboratories. In recognition of his devotion to the interests of his race he was elected president of the World Zionist Organization. His publications include many scientific articles in chemical journals.

WELCH, WILLIAM HENRY (1850-), American pathologist, of Norfolk, Conn. He was a pupil of Cohnheim's, was professor of pathology at Bellevue Hospital Medical College (1879-84), at Johns Hopkins University (1884), and director of the School of Hygiene (1916-26). Welch's name is closely associated with advancement in bacteriology and pathology in America. He made important studies on embolism and thrombosis, and, with Flexner, demonstrated the pathologic changes following experimental injection of the toxins of diphtheria. In 1926, he was appointed to the new chair of medical history in the Johns Hopkins University. Dr. Welch organized and developed the great Welch Library of Medical History, which was dedicated in 1929.

M.F.

WELCH, a city in southern West Virginia, the county seat of McDowell Co., situated 32 mi. northwest of Bluefield. The Norfolk and Western Railroad serves the city, which is a trade center for a large coal-mining and lumbering region. Pop. 1920, 3,232; 1930, 5,376.

WELDING, the joining of metals by fusing the adjoining parts into a continuous mass. Formerly the two pieces to be joined were brought to the fusing heat and then forced together, sometimes by pressure but usually by hammer blows. Or they were fused with hot metal, as in **THERMIT WELDING**. High temperature gas flames, as oxy-acetylene, and the intense heat of the electric arc, now make it possible to weld many parts that formerly could not be joined. In high production manufacturing, electricity is also used for welding both by the resistance and by the spot-welding methods, some semi-automatic machines welding seams at a very rapid rate. Many manufacturing processes have been revolutionized by electric welding. Welding is also closely related to metal cutting especially that done by the torch method. See **METAL CUTTING BY HEAT**.

Welding differs from both **BRAZING AND SOLDERING** in that the surfaces to be welded must be heated sufficiently to fuse together. The old method was to heat both parts in a blacksmith's forge to the fusing or welding heat, place the ends together and hammer the joint until a complete fusion took place. This method is still used in some cases. Nearly 50 years ago Dr. **ELIHU THOMSON** devised a method of welding by the incandescent or resistance method, using electricity as the source of heat. By butting together the pieces to be welded and passing current through them, the ends are heated to the fusing point; the pieces are then forced together, the current shut off and the work held until it cools. This method was not adopted rapidly but is now a standard operation in many industries.

Next came oxy-acetylene or gas welding, in which a mixture of oxygen and acetylene gases produce a very hot flame that melts the surfaces to be joined and also melts a rod of metal into the joint in much the same way as solder is melted into a soldered joint. This was followed by electric arc welding where the heat is secured by forming an electric arc between a piece of carbon or a welding rod, and the metal to be welded. The action is identical with that of the **ARC LAMP** in which the two carbons are first put in contact with each other and then drawn apart enough to form the size of arc desired. This arc is very hot and melts the welding rod into the joint in much the same way as the gas welding torch. Both the gas and arc methods have their fields of usefulness, which sometimes overlap to some extent. The electric arc method is rapidly growing in favor in the welding of large steel plate work such as generator frames that were formerly of cast steel, and to some extent arc welding is supplanting rivets in the construction of steel buildings and of ships.

The gas flame is also largely used for cutting steel

plates and ingots, it being possible to cut steel up to 24 in. or more in thickness at a rapid rate. In some instances the arc is also used for cutting but it is believed to have a much more limited field in this kind of work.

F. H. C.

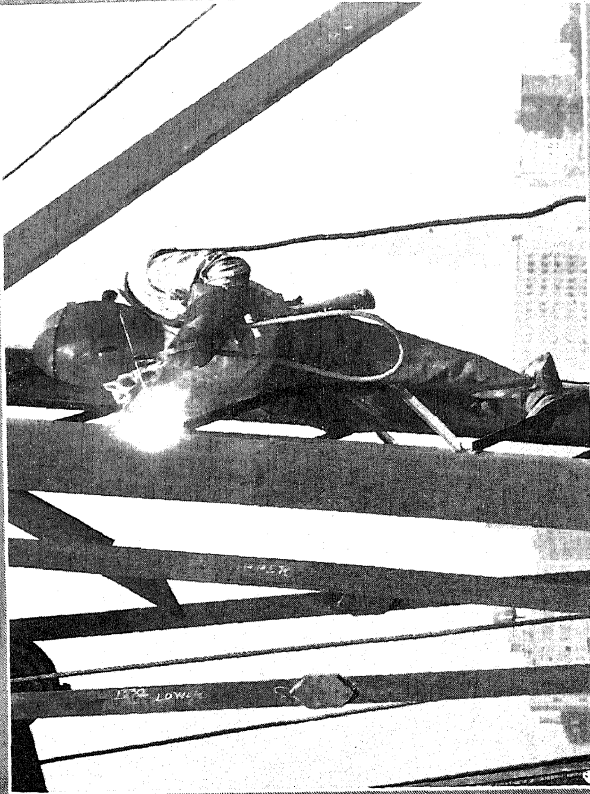
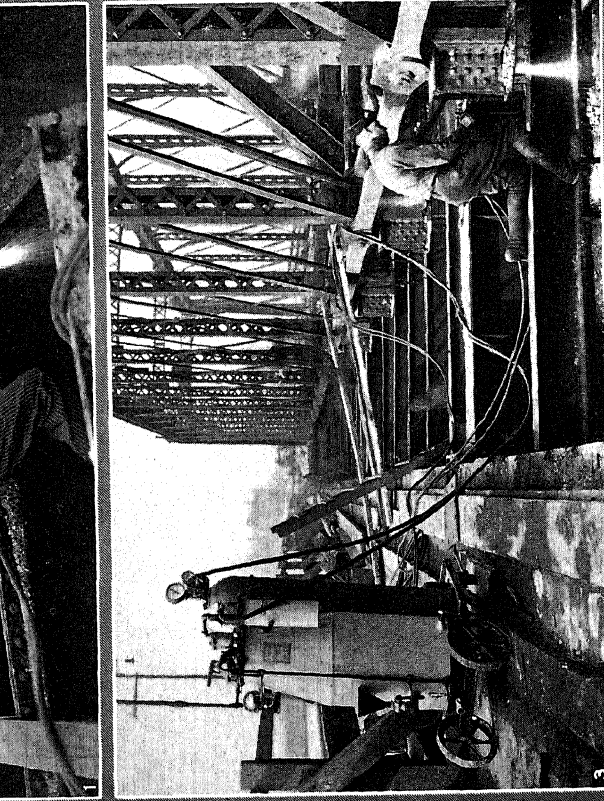
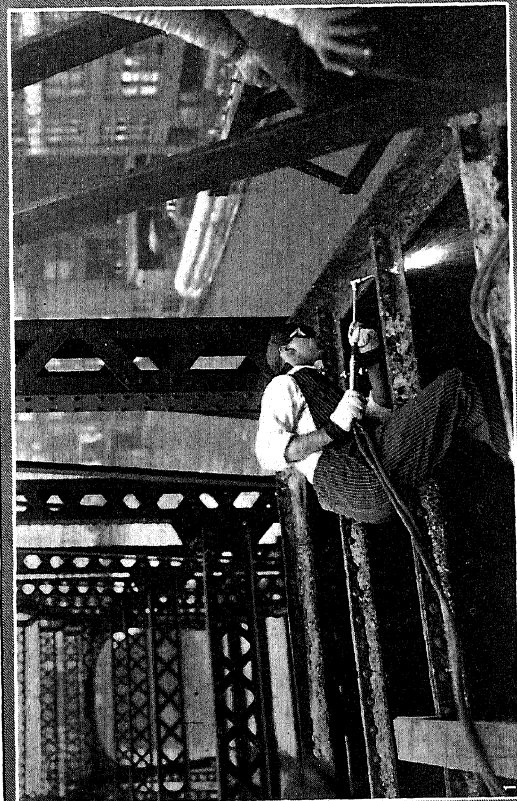
WELFARE WORK. Business and industrial concerns often put at their employees' disposal comforts and facilities not required by law or stipulated in trade agreements. These activities are conventionally referred to as Welfare Work. The term, so defined, commonly excludes provision of safety devices, sanitary conveniences and the like, which are prescribed by statute or collective agreement.

Many employers find it desirable to provide lunch rooms or cafeterias where their employees may buy wholesome food on the premises at reasonable prices; corporation schools or other education facilities; job or occupational training; Americanization classes for training in citizenship; library, medical, hospital and dental services; pension and insurance provisions, other than workmen's compensation insurance. Recreation rooms, equipped with radio, books, magazines and games, where employees may rest and enjoy themselves during the noon hour are sometimes provided. The more elaborate recreational facilities which some companies furnish in the shape of country clubs, summer camps, gymnasiums and swimming pools are designed to promote the physical and social welfare of the workers. In some cases employees' club houses are supported and managed jointly by employers and workers. The equipment for these services range from simple requirements of an ordinary factory lunch room to the elaborate and costly schemes incorporating almost every sort of health and recreational service provided by some of the very large corporations.

Welfare services when not pushed to excessive lengths and when democratically, or at least tactfully, administered have in many instances been found to improve *esprit de corps*, stabilize personnel, increase output and cut down labor turnover. In industrial communities which are remote from the larger centers of population, where workers cannot easily get entertainment and recreation on their own the more elaborate schemes have had a large measure of success and some of the larger concerns have been able, in this way, to set up a kind of benevolent autocracy acceptable to their employees as a partial compensation for the disadvantages of their isolated situation. Department stores employing large numbers of women and businesses employing large numbers of clerical employees have found welfare work especially efficacious.

Critics of welfare work have charged that the cost of these activities is usually subtracted from wages. Certainly most workers would prefer to have the money expended on welfare work added to their wages and to seek education and entertainment, in their own separate ways. Moreover, workers frequently resent the paternalism implicit in the assumption that employers will spend money for the edifica-

WELDING



1, 2, COURTESY IMPERIAL BRASS MFG. CO.; 3, 4, LINCOLN ELECTRIC CO.

ELECTRIC AND GAS WELDING

1. Oxy-acetylene welding of structural members. The acetylene generator is shown at the left.
2. Welding of metal pipe sections by the electric arc method.
3. Welding of bridge structure with an oxy-acetylene torch.
4. The electric arc is used in steel construction welding.

tion and recreation of their employees more wisely than the employees can spend it. They resent still more the elaborate and obtrusive forms of welfare work which reach beyond the factory gates and into their own back yards. Perhaps the most vigorous opposition to welfare work emanates from the trade unions whose members believe that employers often resort to welfare work as a means of forestalling the unionization of their establishments. P. F. B.

Welfare Work by Labor Unions. A number of the organized labor associations have adhered to the principle of limiting union activities rather strictly to those directly concerned with the improvement of wages, hours of labor and general working conditions. The great majority, however, have favored a wide extension of welfare activities on the ground not only that they are of great value to the members but also that they increase the solidarity of the membership and constitute an added inducement for joining the organization.

The most usual of these beneficial activities is the provision of various benefit systems to cover death, sickness, invalidity, old age, strikes and unemployment. A survey of this subject by the U.S. Bureau of Labor Statistics in 1927 showed that of 78 national unions furnishing data, 63 paid benefits for death, 14 for disability and 12 for sickness. In addition 13 made provision for aged members and 20 had some form of insurance system. Seven maintained homes for the aged and disabled and two of these, the Typographical Union and the Printing Pressmen's Union also had tuberculosis sanitariums in connection with their homes. The financial importance of these activities is indicated by the fact that in 1929, according to a compilation by the executive council of the AMERICAN FEDERATION OF LABOR, the benefit services of the national unions affiliated with or recognized by the federation amounted to more than \$37,000,000.

In addition to providing insurance benefits, labor organizations have established two insurance companies of their own. These are the Union Cooperative Insurance Association of the Brotherhood of Electrical Workers and the Union Life Insurance Company of the American Federation of Labor. Also, certain labor groups have established health services, such as the Union Health Center of New York City, which furnishes medical and dental treatment to several thousand union members. Other unions, while not establishing health services of their own, make financial contributions to private institutions with the understanding that their members may receive treatment when necessary.

A fairly new departure in the field of trade union welfare activity is the encouragement and assisting of members in the financing and construction of homes. The Amalgamated Clothing Workers Association in New York City has been particularly active in this field, and has constructed apartment houses containing several hundred apartments which are sold to members on a cooperative basis.

Other welfare activities of labor unions include a

number of labor banks, many credit unions, educational services, cooperative stores, cooperative purchasing organizations, cooperative laundries, funeral associations and the establishment of labor temples in various communities as headquarters for the social, recreational and business life of the local labor groups.

W. J. LA.

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WELLAND, the county seat of Welland Co., Ontario, Canada, situated on the Welland Ship Canal, and on seven railroads, about 49 mi. due south of Toronto and 14 mi. southwest of Niagara Falls. A good harbor, natural gas and hydroelectric power are among the city's advantages, and it is a shipping point for an excellent fruit-growing area. One of the most important industrial centers of southwestern Ontario, Welland includes structural steel, iron and rope works, rubber factories, cotton and flour mills, and a shipyard among its numerous industrial plants. Pop. 1921, 8,654; 1931, 10,709.

WELLAND CANAL, a waterway connecting Port Colborne on Lake Erie with Fort Weller on Lake Ontario, and running parallel to the Niagara River. In its length of 25 mi. it overcomes a difference in water level of 326.32 ft. by means of seven lift locks, each with a lift of 46½ ft., and one guard lock of variable lift. The locks measure 829 by 80 ft. in the clear and provide a depth of 30 ft. of water over the miter sills. These dimensions apply to the new Welland Canal opened in 1930. It took 17 years to build and cost the Canadian government approximately \$120,000,000.

The first Welland Canal was opened in 1829 and extended from Lake Ontario to Point Robinson on Chippewa Creek which emptied into the Niagara River above the falls. It had 40 wooden locks 110 ft. long, 22 ft. wide, with 8 ft. of water. Teams of 12 and 16 oxen helped pull the schooners along the shore to Lake Erie. In 1840 the Canadian government replaced the 40 wooden locks with 27 stone locks ranging in length from 150 to 230 ft. and having a depth of 10¼ ft. of water on the sills.

WELLER, SAMUEL, the droll servant to Mr. Pickwick in Dickens's *PICKWICK PAPERS*. He owed much of his knowledge of human ways and folly no doubt to his earlier experience of being the "Boots" at the White Hart Inn. His common-sense, his keen wit and his human qualities make Sam Weller a servant similar to Sancho Panza in *DON QUIXOTE*.

WELLES, GIDEON (1802-78), American statesman and Cabinet member, born at Glastonbury, Conn., July 1, 1802, and educated at Norwich University, Vt. At the age of 24 he became editor of the *Hartford Times*, in the columns of which he supported Andrew Jackson in his campaign for the presidency. His services as a leader of the new Democratic party were recognized in 1827 by his election to the state legislature, where he served intermittently until 1835. Jackson rewarded Welles by appointing him postmas-

er at Hartford in 1835, a post he held for seven years. His anti-slavery views became more pronounced as the years passed, and the Kansas-Nebraska bill controversy finally led him to break with the Pierce administration. In 1855 he helped to organize the Republican party, and in 1861 was appointed Secretary of the Navy by President Lincoln. He showed remarkable ability in dealing with the naval problems in war time, and continued in this office until 1869. His diary kept during that period is an excellent source of information of the political difficulties of the Lincoln administration. He died in Hartford, Conn., Feb. 11, 1878.

WELLESLEY, a town and village in Norfolk Co., eastern Massachusetts. The village, situated 12 mi. southwest of Boston, is served by buses, trolleys and the Boston and Albany Railroad. Wellesley is the seat of the Wellesley College for Women, founded by Henry Fowle Durant, and chartered in 1870. Other well-known institutions located here are the Babson Institute, the Academy of the Assumption, and Dana Hall School for Girls. On the Hunnewell estate are the noted Italian gardens. The retail business in 1929 totaled \$4,300,201. Wellesley was founded about 1640, and was a part of the Massachusetts Bay Colony. The town was set off from Needham and incorporated in 1881. Pop. 1920, 6,224; 1930, 11,439.

WELLESLEY COLLEGE, a non-sectarian institution for women, situated in Wellesley, Mass. It was founded by Henry Fowle Durant not only to "offer to young women opportunities for education equivalent to those provided at Harvard and other leading institutions . . . for young men, but to build an institution to the glory of God." Under the original charter, 1870, the name of the institution was Wellesley Female Seminary, but this was changed in 1873 to Wellesley College. The preparatory department which had been included in the original college was continued until 1881. From the outset Wellesley was a pioneer in furthering scientific study and was the first college to offer such courses to women. In 1931-32 there were 1,520 students and a faculty of 165 headed by ELLEN F. PENDLETON. Wellesley had an endowment fund in 1931 of \$7,520,844, largely raised by her own alumnae. The library, which contains 141,649 volumes, has several valuable collections, the Plimpton collection of Italian manuscripts, the Ruskin collection and Prof. Palmer's collection of rare manuscripts of first editions of poetry from Chaucer to Masfield.

WELLINGTON, DUKE OF (1769-1852), British general and statesman. Arthur Wellesley, or "Wesley," as at first he signed his name, was born at Dublin, on Apr. 29, 1769. A son of the first Earl of Mornington, he was "great in council, great in war." He was educated at Eton and received his military training at Chelsea, England, and at Angers, France. Serving as aide-de-camp to two viceroys in Dublin, he learned diplomacy and politics, being elected to the Irish Parliament in 1790. It was the outbreak of the struggle with France in 1794 that led him to

active service in the Netherlands. Holding a subordinate command, he won distinction, but he was opposed to the incompetent generalship of the Duke of York, son of George III, and, by way of protest, sought civil employment. Instead he was made a colonel in 1796 and sent to India.

He arrived there with his regiment in 1797, his elder brother, Marquis Wellesley, being appointed governor general the following year. He took part in numerous minor expeditions, was made governor of India and defeated the chieftain of Doondrab in 1800. He commanded the expedition against the Mahratta, and negotiated peace in 1803. Returning to England in 1805 he was knighted and next year entered the House of Commons. In 1807 he was appointed secretary for Ireland.

With the steady extension of Napoleon's power, however, military abilities singled him out for military service, and in 1808 he was made lieutenant general and commander of the forces in Portugal and Spain. During the next six years his patient, dogged perseverance against odds won victory after victory until the French were driven across the Pyrenees. He himself had crossed over into France with his army and was well along towards Paris when Napoleon abdicated in April 1814. As a reward for his services, he was made Duke of Wellington and voted sums which, inclusive of a pension, exceeded \$5,000,000. In 1814-15 he served as ambassador in Paris and attended the Peace Congress at Vienna as British plenipotentiary. When Napoleon escaped from Elba, Wellington met his great rival for the first and last time, and defeated him at Waterloo on June 18. While the allies were in Paris and during the subsequent occupation of territory in 1818, Wellington was commander-in-chief.

After the war he entered the cabinet in 1819, was sent as ambassador to Russia in 1826 and on his return became prime minister, 1828-30. Although a Tory by conviction he forced his party to concede Catholic Emancipation and, in consequence, had to fight a duel with the Earl of Winchelsea. On the other hand, he declared against parliamentary reform. The existing government of England, he declared, was the very best that could be desired. Defeated in the House, he resigned. In 1834-5 he was foreign secretary and as a member of the cabinet from 1841 to 1846, he supported Peel in the abolition of the navigation laws. In 1848 he organized the defense of London against the Chartists. The Duke's great services to the nation in the Napoleonic wars, his staunch torism, his courtly demeanor and strong personality, and especially the "Wellington nose," greatly impressed his generation. Queen Victoria called him "the old rebel," but did not dare omit his name from invitations to her wedding. Despite this, he became very unpopular with the masses, London mobs frequently becoming very threatening. He was commander-in-chief and Constable of the Tower; and as Lord Warden of the Cinque Ports, he spent much time at Walmer Castle where on Sept. 14, 1852 he

died. An ode by Tennyson celebrated his burial in St. Paul's Cathedral where a fine monument by Alfred Stevens was erected in his honor. W. C. L.

WELLINGTON, the capital of New Zealand, picturesquely situated at the southern end of North Island on Port Nicholson, Cook Strait, with an excellent harbor 6 mi. long and 5 wide. Wellington leads the Dominion in shipping, the port facilities being of the highest order. Tanneries, breweries, flour mills and shipyards are important industrially.

The city is surrounded by high, rugged hills. There are several parks and reserves, imposing public and business buildings, art galleries, colleges and Victoria University. The shore driveway, 30 mi. long, is famous for its scenic beauty. Wellington was founded in 1840 as Port Nicholson by immigrants brought out under the auspices of the New Zealand Company. Principally because of its more central position, the city succeeded Auckland as the capital in 1865. Pop. 1931, 111,500.

WELLINGTON, a city and the county seat of Sumner Co. in southeastern Kansas, situated 32 mi. south of Wichita. Bus lines and two railroads serve the city. There are oil and salt fields, the latter unworked, in the vicinity, and the region produces a large quantity of grain, dairy products and live stock. Wellington has 3 flour mills, railroad shops, tie-treating plant and terminal elevator. It has adopted the commission form of government. Wellington was founded in 1871. Pop. 1920, 7,048; 1930, 7,405.

WELLS, DAVID AMES (1828-98), American economist, was born at Springfield, Mass., June 17, 1828. He joined the faculty of Harvard University in 1851. In 1864 he published a study of the national debt, *Our Burden and Our Strength*, as a result of which he was made chairman of the National Revenue Commission in 1865. The following year he was appointed special Commissioner of Revenue. Wells was chiefly responsible for the formation of the statistical bureau in the Treasury Department. At first a protectionist, he became an ardent free-trade advocate, and wrote *A Primer of Tariff Reform*, 1884, and *The Relation of the Tariff to Wages*, 1888. He died at Norwich, Conn., Nov. 5, 1898.

WELLS, HERBERT GEORGE (1866-), English novelist and historian, was born Sept. 11, 1866, at Bromley, Kent. His family was in straitened circumstances, but with the aid of scholarships he graduated in 1888 from London University with first class honors. He taught private pupils in science, wrote for newspapers, and in 1895 began his career as a novelist with *The Time Machine*. Wells has written more than 60 books, the majority novels. In his early stories he combined knowledge of science and a powerful and vivid imagination to produce unique and striking tales that were immediately successful. Among these are *The War of the Worlds* and *The Island of Dr. Moreau*. Later he turned to portraying contemporary life, as in *Love and Mr. Lewisham*, *History of Mr. Polly*, *Tono-Bungay*, *Ann Veronica*, and the war novel, *Mr. Britling Sees It*

Through. Still later he made his novels vehicles for his vigorous thinking on politics, economics, education and other matters, such as *Joan and Peter* and *The World of William Clissold*, 1926. Wells also wrote the *Outline of History*, 1920, a work covering the story of mankind from its beginning; with J. S. Huxley and G. P. Wells *The Science of Life*, 1931, several books of travel, and many on economic subjects of prophetic and propagandist character, including *The Work, Wealth and Happiness of Mankind*, 1931.

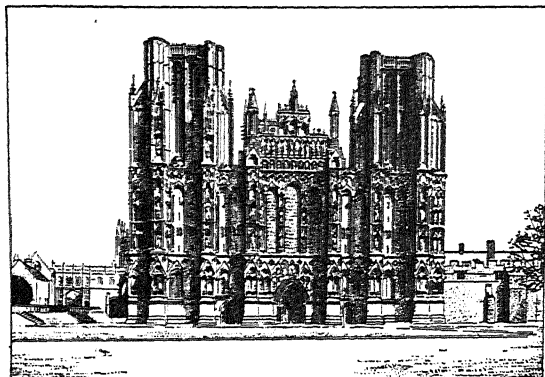
WELLS, HORACE (1815-48), American dentist and oral surgeon, was born at Hartford, Vermont, Jan. 21, 1815. In 1834 he began the practice of dentistry at Hartford, Conn., after study at Boston. In 1840 he conceived the possibility of extracting teeth painlessly by the use of an anesthetic. Investigation convinced him that nitrous oxide (laughing gas) was the most efficacious agent, and after thorough trial upon himself, in 1844 he used this gas upon his patients. Wells made the discovery independently of others and was the first to use nitrous oxide as an anesthetic in dentistry. See also MORTON, WILLIAM THOMAS. He died at New York City, Jan. 24, 1848.

WELLS were the first recourse of primitive man for obtaining water in arid regions and places removed from lakes and streams. Wells yielding any considerable quantity of water must penetrate or go below water-bearing strata, and those where the natural pressure was sufficient to force the water to the surface were called "artesian" wells from the French province of Artois where the first of such wells was sunk. Originally the name was confined to flowing wells but is now commonly applied to all wells reaching strata under natural water pressure. See also SPRINGS; ARTESIAN WELLS.

WELLS, an old town in Somersetshire, famous for the possession of one of the finest cathedrals in England, and itself probably the country's most characteristic cathedral town. Professor Freeman declares that the group of cathedral buildings at Wells is "without a rival either in our own island or beyond the sea." This group includes the Bishop's Palace of the 13th century, still surrounded by its moat and bastioned wall of a century later; the Deanery, Cathedral School and residences of the Archdeacon, precentor, organist and architect, nearly all of which structures date from the 15th century. Most picturesque of all is the double row of charming old houses known as the Vicar's Close, built in the 14th and somewhat altered in the 15th century. They are connected with the north transept of the cathedral by a medieval bridge.

The Cathedral of Wells is built mainly in the Early English style. It stands within a beautiful close, approached through ancient gates. The oldest part, the fine north porch, dates from before 1189, but the greater portion of the church was erected between that date and 1319. The broad west façade, built in 1220-42, is highly impressive, and its wealth of medieval figure sculptures is unrivaled in England. The nave has an unfortunate feature in the inverted

arches at the entrance to the crossing; yet the finest part of the interior is the east of the nave, where choir, presbytery and lady chapel combine to form one of the most beautiful of English church interiors. The work,



WELLS CATHEDRAL, WEST FRONT

though ranging from Norman Transitional to Geometrical Decorated, produces an effect of rich and exquisite harmony. The lady chapel was finished in 1326 and the presbytery dates from about 1350. Unlike most English churches, Wells has clustered chapels at the east end, reminiscent of the cathedrals of Le Mans and Amiens, and these form an apse of rare beauty. Another splendid feature is the chapter house, built in about 1300. Pop. 1921, 4,369; 1931, 4,833.

WELLSBURG, a city in northern West Virginia, the county seat of Brooke Co. It is situated on the Ohio River, 16 mi. north of Wheeling and is served by river craft and two railroads. The manufactures include glass, paper, sacking and metal products. Coal mining is a leading interest. Pop. 1920, 4,918; 1930, 6,398.

WELLS COLLEGE, at Aurora, N.Y., a privately controlled college for women, founded in 1868 by Henry Wells, as Wells Seminary. In keeping with the policy of the founder, Wells has remained a small college. Its productive funds in 1931 amounted to \$1,636,244. The library contained 70,500 volumes. In 1931-32 there were 260 students and a faculty of 41, headed by Pres. KERR D. MACMILLAN.

WELLSTON, a city in Jackson Co., southern Ohio, situated 35 mi. northeast of Portsmouth on Little Raccoon Creek and served by three railroads. There are coal and iron mines and many gas wells found in this region, and the city has furnaces, machine shops, foundries and a cigar factory. Nearby are Salt Springs, Canters Cave and several state parks. Pop. 1920, 6,687; 1930, 5,319.

WELLSVILLE, a village in Allegany Co., southwestern New York, situated on the Genesee River, 90 mi. southeast of Buffalo. It is served by two railroads. Gas and crude oil are found in this region. Wellsville has machine shops and factories producing furniture, aluminum, turbines and caskets. Also located here is the largest crude oil refinery in the world. Pop. 1920, 4,996; 1930, 5,674.

WELLSVILLE, a city in Columbiana Co., eastern Ohio, situated on the Ohio River, 4 mi. west of East Liverpool. It is served by river steamers, ferries to Congo, W.Va. and the Pennsylvania Railroad. Oil, gas, coal and clay are found in this region. The city has pottery plants, iron works and machine shops. Wellsville was founded in 1797 and incorporated in 1833. Pop. 1920, 8,849; 1930, 7,956.

WELS, a city in Upper Austria dating back to Roman times. It is an important market for horses, cattle, butter and eggs. It has machine and other factories, whose operations are facilitated by the use of natural gas found in the immediate neighborhood, which is also utilized for heating and illuminating. There is a fine Gothic parish church and an ancient fortress in which Maximilian I died in 1519. Pop. 1923, 16,412.

WELSBACH, KARL AUER, BARON VON (1858-), Austrian inventor, was born at Vienna, Nov. 1, 1858. He received a technical education at the universities of Berlin and Heidelberg. In 1885 the discovery of two new elements, praseodymium and neodymium, which become incandescent at low temperatures, led to his invention of the Welsbach light, or gas-mantle. He improved his original invention by evolving the osmium incandescent electric lamp in 1898 and in 1907 he discovered lutecium, a third new element. To foster technical and scientific research in the field of undiscovered elements, he built an experimental station at Treibach, Kärnten.

WELSBACH BURNER; essentially a special form of BUNSEN BURNER, the end of which is enclosed by a fragile *mantle*; invented about 1885 by KARL AUER VON WELSBACH. When heated by the burner, the mantle becomes incandescent, and the light from it is much more intense than that from the same amount of gas burned in an ordinary burner. When manufactured, the Welsbach mantle consists of a suitably shaped network of cotton threads, impregnated with THORIUM and CERIUM nitrates and stiffened with COLLODION. After the mantle has been installed, the collodion is ignited, the cotton burns away and the nitrates are converted into the corresponding oxides. It is this very fragile network of thorium and ceria, which retains its original shape, that furnishes the light.

WELSH LANGUAGE, the chief representative of the Brythonic branch of the CELTIC group of the INDO-EUROPEAN linguistic family, spoken by about 1,000,000 persons in Wales.

The language falls into three periods: Old (about 800-1100 A.D.), Middle (about 1100-1500) and Modern (from about 1500 onward), and is now divided into four dialects: Venedotian (Gwynedd, northwest), Powysian (Powys, northeast and middle), Demetian (Dyfed, southwest) and Gwentian (Gwent and Morgannwg, southeast). As in all Brythonic languages, a heavy stress-accent, now generally on the antepenult, but earlier on the final syllable, has caused the old inflectional endings to disappear, so that the noun for the most part has retained but one form for the singular and another for the plural. The dual and

neuter have survived only in scanty traces. The verb, on the other hand, has kept most of its original Celtic inflection with indicative, subjunctive and imperative moods, the indicative having four tenses: present (often serving as future), imperfect, preterite (aorist or perfect) and pluperfect, of which only the latter is a specifically Brythonic creation. As in Celtic generally, there is a special form for the impersonal verb ("one does"), but the passive has disappeared, though Middle Welsh still retains a few passive as well as future indicative forms. L. H. G.

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WELSH LITERATURE, the literature of Wales, which is discussed in the article on **CELTIC LITERATURE**.

WENATCHEE, a city in central Washington, the county seat of Chelan Co., situated on the Columbia River, 170 mi. southeast of Seattle. The Great Northern Railroad and bus lines afford transportation. Wenatchee is a trading and shipping point for a vast apple-growing district. Lumber milling is the principal local industry. In 1929 the retail trade reached \$17,782,258. The city was founded in 1871. Nearby are Wenatchee National Forest and several beautiful lakes and mountain streams. Pop. 1920, 6,324; 1930, 11,627.

WENATCHI, a North American Indian tribe, probably a sub-group of the Pisuow who were themselves a sub-tribe of the Cœur d'Alene, who belonged to the Salishan linguistic family. Their former habitat was along the Wenatchee River in Washington. The few members of the tribe remaining have been reported on the Yakima and Colville reservations in Washington.

WENCHOW FU, a treaty port of China, 20 mi. from the mouth of the River Wu which flows into the East China Sea on the southern coast of Chekiang province. Customs are outside the North Wall of the city, and Foreign Residences are on the island, Ching Hsin Ssu, sometimes called Conquest or Two Pagodas Island. The chief exports are tea and fruits. Frequent riots occur among the people who have been described as "lethargic and unenterprising." Pop. 1929, 678,376.

WENDELL, BARRETT (1855-1921), American educator and author, was born in Boston, Mass., Aug. 23, 1855. He graduated from Harvard in 1877 and then studied at the Harvard Law School. After practicing for two years, he was appointed in 1880 instructor of English at Harvard, then became assistant professor, and from 1898 until his death was professor. He was exchange professor at the Sorbonne for a year, and as a result of his observations wrote his *France of Today*. As scholar and educator Wendell was internationally known. Among his publications are *English Composition*, a standard textbook, *A Literary History of America*, *Shakespeare* and *The Mystery of Education*. Wendell died in Boston, Feb. 8, 1921.

WENDS, or foreigners, a name applied by the Franks to all Slavs, but later limited to those Slavic tribes dwelling between the Elbe and the Oder. In the 7th century they plundered Thuringia and Bavaria, defeating a force sent against them by Dagobert I in 630. During succeeding centuries they made intermittent raids into Germany, until the Saxons under Henry I began their long continued eastern offensive against the Slavs. The Church wished to convert them and collect tithes, the nobles desired tribute, and the peasants were eager to possess their lands. Repeated rebellions of the subjugated Slavs occurred, the most formidable in 1066. But these rebellions resulted only in new conquests and confiscations, culminating in the great Wendish Crusade of 1147, approved by St. Bernard of Clairvaux. German supplanted Slav in the conquered districts, and the towns founded by the conquerors shortly became the commercial dictators of the north.

WENER, Vener or Vaner, the third largest lake in Europe and the largest in Sweden. In the southern portion of the Scandinavian peninsula, it extends for 90 mi. from northeast to southwest, with an area of 2,140 sq. mi., a maximum breadth of 45 mi. and a depth of 290 ft. The indented shores are jagged or heavily forested in the north and generally low in the south; in the center two peninsulas jut out to divide the basin. This body of water receives many streams, the largest being the Klar, and discharges through the Gota. Canals connect the lake with Frederikshald, Norway, and with Lake Wetter. Karlstad and Kristinhamn on the north shore, Lidköping and Venersborg on the south, are among Lake Wener's industrial centers and are active as shipping ports for lumber, iron, and farm products.

WEREWOLVES, human beings who, according to widespread belief, can be changed into wolves by magic spells. Another name is lycanthropes. See **WITCHCRAFT**.

WERFEL, FRANZ (1890-), German poet, playwright and novelist, was born at Prague, Sept. 19, 1890. His début as a writer was made with poems, *Weltfreund*, 1912, *Wir sind*, 1913, and *Einander*, 1915. Turning to drama, he had the greatest success with *Spiegelmensch, eine magische Trilogie*, 1920, his *Bockgesang*, 1921, and *Schweiger*, 1922, being less well received. In *Juarez und Maximilian*, 1924, he threw off the expressionistic manner to produce an objective, historical drama of poignant interest. A later effort, *Paulus unter den Juden*, appeared in 1926, and Werfel later had success as a novelist with his *Der Abiturienten Tag*, translated as *Class Reunion*.

WERGELAND, HENRIK ARNOLD THAU-LOW (1808-45), Norwegian poet, was born at Christiansand, June 17, 1808. As a schoolboy and as a student at the university he wrote poems, plays and dramatic sketches. Shortly after completing his theological studies he wrote the work that he considered his best, a long epic poem entitled *Creation, Man and Messiah*. It was severely criticized by the contemporary poet, J. S. Welhaven, and a violent

controversy ensued. Wergeland was an ardent champion of the newly awakened Norwegian nationalism, which sought to abolish everything that remained of the long-established Danish influence. In this also he was opposed by Welhaven. It is as a lyric poet that Wergeland is remembered. His best-known works include *Jan van Huysum's Flower-Piece*, *The Jew*, *The Jewess*, *The Swallow* and *The English Pilot*. He died at Oslo (Christiania), July 12, 1845.

WERNER, ABRAHAM GOTTLÖB (1750-1817), German geologist, was born at Wehrau, Saxony, Sept. 25, 1750, the son of a miner. He studied mineralogy at the Freiberg School of Mines and at the University of Leipzig, and in 1775 returned to Freiberg as inspector in the School of Mines. There he devoted the rest of his life to the study and teaching of systematic geology, and his teachings made the school one of the most famous in the world and influenced the entire development of his science. Werner advanced the views that almost all rocks originated as sediments laid down in the ocean and that geological formations were uniform throughout the earth. Both views were extreme, but contributed importantly to the development of systematic geology. Werner died at Freiberg, June 30, 1817.

WERNICKE'S APHASIA. See APHASIA.

WESER, an important German river. Formed by the confluence of the Werra and the Fulda rivers at Münden, in northwest Germany, it flows north in a tortuous course, receives the Aller as principal tributary and turns west to enter the North Sea near Bremerhaven, where sand bars obstructing its mouth make navigation difficult. It is a shallow waterway, 440 mi. long from the source of the Werra River and 280 mi. long from Münden, to which large boats can ply at high water. Smaller craft can ascend both the Werra and the Fulda, which have been canalized. The Weser has water connections with both the Ems and the Elbe rivers through canals. Above Bremen, where rapids occur, locks and weirs improve the river's course. Bremen is the chief town on its banks.

WESERMUNDE, a German city in the Prussian province of Hanover, formed in 1924 by uniting the cities Geestemünde and Lehe, which surround Bremerhaven. The latter belongs to the free city of Bremen. Wesermünde is both a shipping and fishing port and has shipbuilding yards, iron foundries and saw mills. It is the largest German fish market. Pop. 1925, 73,544.

WESLACO, a city in Hidalgo Co., southern Texas; situated near the Rio Grande, about 250 mi. south of San Antonio. The Missouri Pacific Railroad and bus lines serve the city. The chief crops of the region are citrus fruit and vegetables. The city is a new trade center in the Rio Grande valley; it was founded about 1920 and incorporated in 1922. It has a city manager form of government. Pop. 1930, 4,879.

WESLEY, CHARLES (1708-88), English hymn writer, younger brother of JOHN WESLEY, was born at the rectory of Epworth, Lincolnshire, Dec. 28, 1708. He was educated at Westminster School, London, and

at Oxford, where he helped to organize the first Methodist society. He went to Georgia with his brother John, 1735-36, and was associated with him throughout his life. He is best known as a hymn writer and is credited with the authorship of 6,500 hymns, many of which are standard hymns in Protestant churches. Among them are such favorites as "Hark, the Herald Angels Sing" and "Jesus, Lover of my Soul." Wesley died in London, Mar. 29, 1788.

WESLEY, JOHN (1703-91), English preacher and founder of Methodism, was born at Epworth, Lincolnshire, June 28, 1703. Educated at the Charterhouse school in London and at Oxford, he was ordained in 1725 deacon and in 1728 a priest of the Church of England, in which communion he remained all his life. After a short curacy with his father at Epworth, he returned as lecturer to Oxford, where he became leader of a society for religious improvement which his brother CHARLES WESLEY, George Whitefield and others had organized. Because of their adherence to a prescribed method of life, the members were disdainfully called Methodists.

Under the influence of the mystic, William Law, Wesley set out in 1735 to preach to the colonists and Indians of Georgia but returned to England in 1738, having been so much impressed with a group of Moravian Brethren whom he met on the voyage out that he now went abroad to confer with their leaders at Herrnhut and Marienborn. On his return he imitated the example of Whitefield, to whom the pulpits of England had been closed, and started his outdoor preaching. The foundation of Methodism is usually assigned to the year 1739. During his 50 years of itinerant preaching Wesley traveled on foot and on horseback a quarter of a million miles, reading, studying and organizing Methodist societies as he went. His life was often endangered by mobs; but his sincerity prevailed over the animosity until he was venerated wherever he went. In the midst of his missionary labors he devoted himself to lessening the hardships of the poor, encouraged the spread of education and reading, and took an active part in true anti-slavery movements as in all efforts for the benefit of mankind. He was a prolific writer, considering the little time that he had for writing, and his *Journal*, 4 vols., 1735-90, is one of the most graphic diaries in existence. Wesley died in London, Mar. 2, 1791.

WESLEYAN UNIVERSITY at Middletown, Conn., a non-sectarian, liberal arts college for men founded in 1831 by the Methodist Episcopal Church, but not formally connected with that denomination. It had productive funds in 1931 amounting to \$5,133,479. The library, containing 165,000 volumes, is supported by a special fund. In 1931-32 there were 635 students and a faculty of 63 headed by Pres. James L. McConaughy.

WESSEX, an ancient kingdom of Britain in Anglo-Saxon times, founded about 500 A.D. by the West Saxons under Cerdic and his son Cynric. Landing somewhere near Southampton and after engaging in

a number of battles with the Welsh, they settled in the southwest of England and founded a kingdom. After his father's death Cynric extended his domain over Hampshire and also the Isle of Wight. During the next century there was constant warfare with the Mercians, who were, however, finally defeated; after Egbert came to the throne of Wessex in 800, he subjugated all the people south of the Tweed, becoming first king of the English. ALFRED THE GREAT continued to extend and strengthen the kingdom. The West Saxons embraced Christianity in the 7th century.

WEST, ANDREW FLEMING (1853-), American educator, was born in Allegheny, Pa., May 17, 1853. He graduated in 1874 at Princeton and was professor of Latin there from 1883-1928. In addition he was dean of the graduate school in 1901-28, and planned the Graduate College of Princeton which was opened in 1913. West wrote extensively on classical education in universities, and was the author of a *Latin Grammar*, *American Liberal Education* and *Education and the War*.

WEST, BENJAMIN (1738-1820), English historical painter, was born at Springfield, Pa., Oct. 10, 1738. After severe early struggles West established himself first in Philadelphia and then in New York, where he met with some success. He next studied in Italy for 3 years, then moved to London where his historical canvases soon gained the favor of George III. In 1772 West became official court painter and in 1792, upon the death of Sir Joshua Reynolds, president of the Royal Academy, a post which he held for 28 years. He produced a large religious canvas, *Christ Healing the Sick*, in 1803, which was purchased by the British Institute for 3,000 guineas or about \$15,000. This marked the peak of his success. West's subsequent dull depictions of historic events, rendered in a tight, conventional technique, began to lose popularity. To-day West is remembered, not for his *Death of General Wolfe*, but as the patron of young Gilbert Stuart and the wise teacher who admonished John Constable "to remember that light and shadow *never stand still*." West died in London, Mar. 11, 1820.

WEST, REBECCA (1892-), pseudonym of Cicily Isabel Fairfield, English writer, who was born Dec. 25, 1892, and educated in Edinburgh, Scotland. She attracted attention at an early age with her literary criticisms in the English press, and later became a well-known contributor to American periodicals. In 1930 she married Henry Maxwell Andrews. Rebecca West is the author of *Henry James*, 1916, and of several novels, including *The Return of the Soldier*, 1918, *The Judge*, 1922, and *Harriet Hume*, 1929.

WEST ALLIS, a city in Milwaukee Co., southwestern Wisconsin, situated 2 mi. west of Milwaukee. It is served by bus lines and two railroads. Agriculture is the chief interest of the vicinity. Mining and other machinery are the leading local manufactures. In 1929 the factory output was approximately \$68,000,000; the retail trade was valued at \$14,772,822.

West Allis is the seat of a National Soldiers Home. The city was founded and incorporated in 1906. Pop. 1920, 13,745; 1930, 34,671.

WESTBOROUGH, a town of eastern central Massachusetts, in Worcester Co., situated about 10 mi. east of Worcester. The Boston and Albany Railroad and bus lines afford means of transportation. It is a manufacturing town, with straw hats, underwear, cotton tape and abrasives the chief products. The state hospital for the insane is here. Eli Whitney, inventor of the cotton gin, was born here. It was settled about 1659 and was incorporated in 1717. Pop. 1920, 5,789; 1930, 6,409.

WEST BROMWICH, a market town of Staffordshire, England, about 119 mi. northwest of London and near Birmingham. Situated in the industrial district of the Black Country, evidences of the town's antiquity have become submerged in its modern growth and appearance. However, there is the restored Church of All Saints, formerly St. Clements, presented by Henry I to the Convent of Worcester, and later rebuilt in the Decorated style by the priors of Sandwell who subsequently acquired it. The handsome 16th century Oak Hall has been a public museum and art gallery since 1898, and among the modern institutions of the town are the town hall, free library and law courts. Smelting furnaces and iron and brass foundries are among the local industries and coal is mined in the vicinity. Pop. (of county borough) 1921, 75,097; 1931, 81,281.

WESTBROOK, a city of southwestern Maine, in Cumberland Co., situated on the Boston and Maine Railroad, about 6 mi. northwest of Portland. Manufacturing plants include silk, paper and warp mills and brick works. The retail trade in 1929 amounted to \$3,677,769. Westbrook was part of Falmouth until 1814, when it was organized as the town of Stroudwater. It was renamed Westbrook in 1815. It was incorporated in 1889. Pop. 1920, 9,453; 1930, 10,807.

WEST CHESTER, a borough in southeastern Pennsylvania, the county seat of Chester Co., situated 27 mi. west of Philadelphia. It is served by the Pennsylvania Railroad. Farming is carried on in this region, and pure-bred livestock is raised on large estates in the vicinity. West Chester has foundries, planing mills, machine shops, factories, nurseries and mushroom plants. The manufactured output, 1929, was worth \$1,902,992. The retail business in 1929 amounted to \$10,524,077. The site was settled in 1713; West Chester became a town in 1788, and a borough in 1794. Turk's Head Inn was popular as a village tavern in Colonial times. The Battle of Brandywine was fought 7 mi. south Sept. 11, 1777, and a few days later "Mad" Anthony Wayne with a handful of men routed the British at Paoli, near by. West Chester is the seat of a State Teachers College. Pop. 1920, 11,717; 1930, 12,325.

WESTERLY, a town of southwestern Rhode Island, about 40 mi. southwest of Providence, separated from Connecticut by the Pawcatuck River, with tide-water frontage accessible to the Atlantic via New Lon-

don, Conn. It is served by the New Haven Railroad and also by steamship and bus lines and an airport. Its environs include the villages of Bradford, Misquamicutt and Watch Hill. Settled about 1661 and originally named Misquamicutt, the town was incorporated in 1669. Westerly is an important industrial and business center, producing printing presses, rayon, elastic webbing, silks, cottons and woollens. The retail trade in 1929 amounted to \$6,492,730. A fine quality granite is found here. The village of Pawcatuck, Conn., is a sister community of about 5,200 population. Pop. 1920, 9,952; 1930, 10,997.

WESTERMANN, WILLIAM LINN (1873-), American university professor and historian, was born at Belleville, Ill., Sept. 15, 1873. He was graduated in 1894 at the University of Nebraska and later studied at Berlin. After teaching classical languages at the universities of Nebraska and Missouri, he became associate professor of history at the University of Wisconsin 1908-14, and professor 1914-20. He was professor of ancient history at Cornell from 1920 to 1923, when he was appointed professor of history at Columbia. In 1918-19 he was a member of the American Commission to Negotiate Peace at Paris, and in 1926-27 was professor in charge of the School of Classical Studies at the American Academy in Rome. In 1931 he became a member of the advisory board of the Guggenheim Memorial Foundation. Among his historical works are *Story of the Ancient Nations*, and *Upon Slavery in Ptolemaic Egypt*.

WESTERN AUSTRALIA, a state of the Commonwealth of Australia, includes the western third of the continent west of 129° E. long., an area of 975,920 sq. mi. The population, 4,622 in 1848, had increased to 332,732 by 1921, and was estimated at 418,643 in 1930. PERTH, the capital, with the adjacent port Fremantle, has a population estimated at 202,888. The other principal towns are Claremont, Boulder, Kalgoorlie and Bunbury. Settlement began on the coast of Western Australia in 1829.

There have been rich gold finds at Coolgardie and Kalgoorlie since 1892, but production decreased after 1914. Pastoral and agricultural activities have become important. The inland plains in the southwest corner of Western Australia, the wheat lands, have been called optimistically the future granary of Australia. There are approximately 4,000,000 acres under cultivation. The annual amount of rainfall is only about 10 in., but the soils are generally rich and very easily and cheaply cultivated. A wide range of climate is exhibited. Although the yields of wheat so far obtained are not high, they are reliable. In the season 1927-28, the yield was 12.13 bu. per acre; in 1928-29, 10.12. The average over a score of years is only 10.29 bu. per acre, compared with 12.48 for the whole of Australia, and 15 bu. for the United States.

Little manufacturing is carried on. The exports are wheat and flour, wool, gold, timber (jarrah and sandalwood), pearls, pearl-shell, hides, skins and fruit.

WESTERN ESKIMO, an alternative designation for Alaskan Eskimo; see **ESKIMO**.

WESTERN ISLANDS. See **AZORES**.

WESTERN ONTARIO, UNIVERSITY OF, a coeducational institution at London, Ont., Canada, incorporated in 1878 as a college in connection with the Church of England. It has since become, by amending acts of 1908 and 1923, absolutely un denominational in its government, which is under provincial and municipal control. In 1930-31 there was a student enrollment of 1,378, and a faculty of 218 headed by the Hon. Henry Cocksutt.

WESTERN RESERVE UNIVERSITY at Cleveland, O., a coeducational and non-sectarian institution founded at Hudson, O., as Western Reserve College in 1826. Removed to Cleveland in 1882, it was renamed as Adelbert College. Two years later Western Reserve University incorporated, with Adelbert College becoming the arts department for men. The college for women was established in 1888. The university had an endowment in 1931 of \$11,421,525. The library contained 408,000 volumes. In 1931-32 there was a student enrollment of 9,043, and a faculty of 685 headed by Pres. ROBERT E. VINSON.

WESTERVILLE, a village in Franklin Co., central Ohio. It is situated 12 mi. northeast of Columbus and is served by the Pennsylvania railroad. The surrounding country is devoted to farming. Westerville is the seat of Otterbein University. Pop. 1920, 2,480; 1930, 2,879.

WESTFIELD, a city of Massachusetts, situated in Hampden Co., on the Westfield River, 108 mi. southwest of Boston and 9 mi. west of Springfield. The city is served by the Boston and Albany and the New York, New Haven and Hartford railroads. Three miles distant is the Barnes airport. Westfield has been called the Whip City of the World because it produces 95 per cent. of all whips made. Other manufactures are boilers and radiators, bicycles, paper, cigars and textiles. The value of the manufactures for 1929 was about \$13,000,000; the same year the retail trade amounted to \$19,835,763. Among the leading educational institutions are the Massachusetts State Normal School and a State Normal Training School. Established as a trading-post about 1640, under the Indian name Wau, wau, noko (Woronoco), Westfield became a township under its present name in 1669, and in 1921 was incorporated as a city. Pop. 1920, 18,604; 1930, 19,775.

WESTFIELD, a town of Union Co., N.J., located 18 mi. southwest of New York City and 8 mi. west of Elizabeth. It is served by the Central Railroad of New Jersey and by motor bus lines. Westfield occupies a level site and is characterized by its wide shaded streets and broad lawns. It is the residence of many New York City business men and is a trading center for a district of suburban homes. The retail trade in 1929 amounted to \$7,595,119. Pop. 1920, 9,063; 1930, 15,801.

WEST FRANKFORT, a city of Franklin Co., Ill., about 65 mi. north of Cairo. It is served by the Bur-

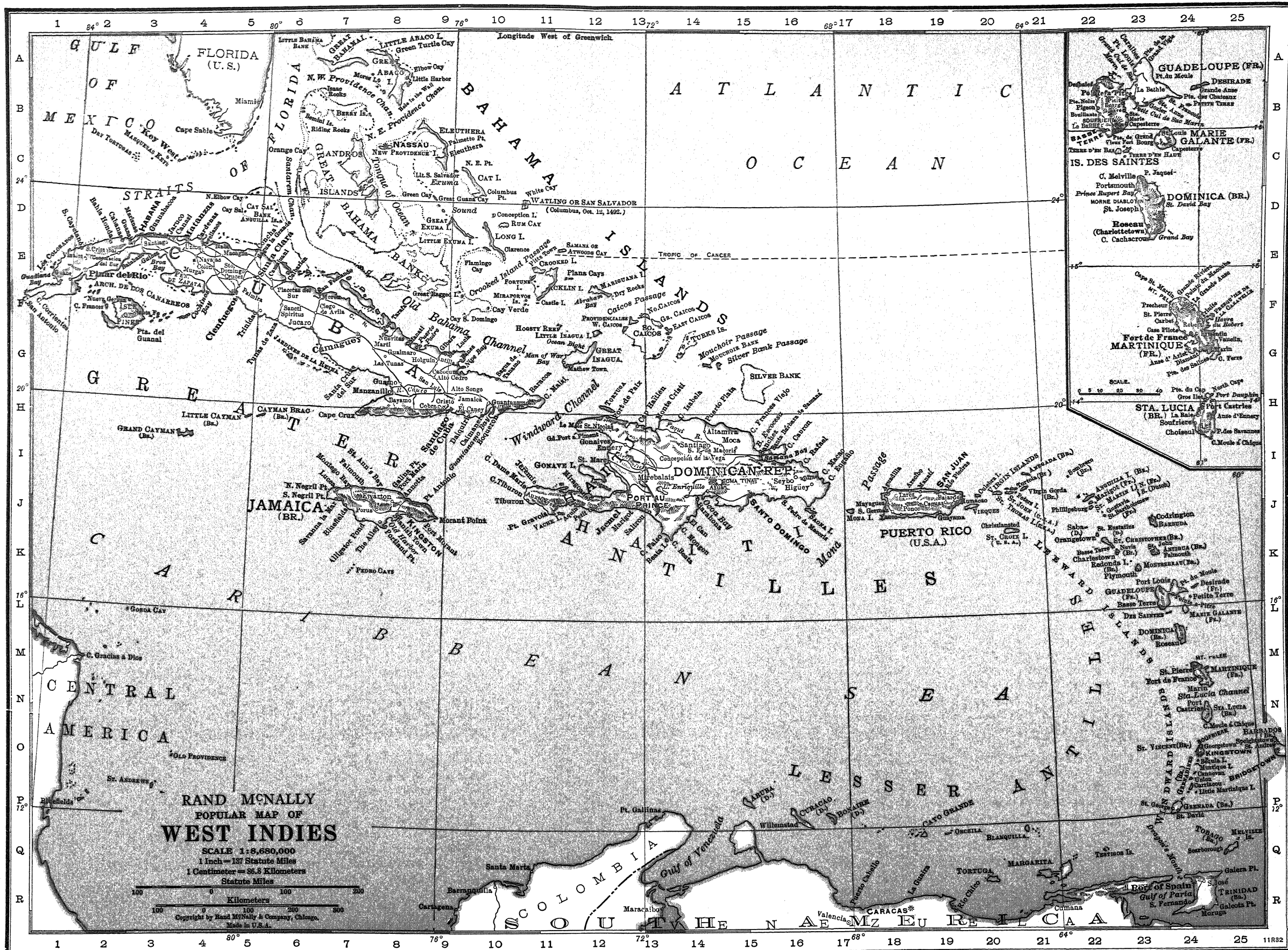
WEST INDIES

PRINCIPAL ISLANDS

Antigua.....	K 23
Area.....	108 sq. m.
Pop.....	30,909
Bahama.....	E 11
Area.....	4,396 sq. m.
Pop.....	60,848
Barbados.....	O 25
Area.....	166 sq. m.
Pop.....	173,674
Barbuda.....	J 23
with Redonda	
Area.....	62 sq. m.
Cuba.....	F 6
Area.....	44,164 sq. m.
Pop.....	3,713,767
Curaçao.....	P 16
(Colony)	
Area.....	403 sq. m.
Pop.....	76,332
Dominica.....	M 24
Area.....	305 sq. m.
Pop.....	42,343
Dominican Republic.....	I 14
Area.....	19,332 sq. m.
Pop.....	1,124,422
Grenada.....	P 24
Area.....	133 sq. m.
Pop.....	75,867
Guadeloupe and Dependencies	L 24
Area.....	688 sq. m.
Pop.....	267,407
Haiti.....	I 13
Area.....	10,204 sq. m.
Pop.....	2,550,000
Jamaica.....	J 8
Area.....	4,450 sq. m.
Pop.....	994,419
Martinique.....	M 25
Area.....	385 sq. m.
Pop.....	232,355
Montserrat.....	K 23
Area.....	32 sq. m.
Pop.....	12,196
Puerto Rico.....	J 18
Area.....	3,435 sq. m.
Pop.....	1,543,913
St. Christopher (St. Kitts).....	K 22
with Nevis	
Area.....	150 sq. m.
Pop.....	30,931
St. Lucia.....	N 24
Area.....	233 sq. m.
Pop.....	57,482
Tobago.....	Q 25
Area.....	114 sq. m.
Pop.....	23,378
Trinidad.....	R 25
Area.....	1,974 sq. m.
Pop.....	413,119
Virgin Is.....	J 20
(British)	
Area.....	58 sq. m.
Pop.....	5,263
Virgin Is.....	J 20
(U. S.)	
Area.....	133 sq. m.
Pop.....	22,012

PRINCIPAL CITIES

Pop.—Thousands	
49 Camaguey.....	G 7
46 Fort de France.....	M 24
53 Guantanamo.....	H 10
589 Havana.....	F 3
68 Kingston.....	J 8
64 Manzanillo.....	H 8
47 Matanzas.....	E 4
42 Ponce.....	J 18
40 Port au Prince.....	J 13
70 Port of Spain.....	R 24
88 Sancti-Spiritus.....	F 6
71 San Juan.....	J 19
145 Santiago de Cuba.....	H 9
45 Santo Domingo.....	J 15



lington, the Illinois Central, and the Chicago and Eastern Illinois railroads. In 1929 the retail trade amounted to \$5,829,940. Extensive coal mines have stimulated industrial activity and, consequently, the growth of population. Pop. 1920, 8,478; 1930, 14,683.

WEST HARTFORD, a town in Hartford Co., just northwest of central Connecticut, adjoining Hartford on the west. The New Haven Railroad serves the town. The region produces milk and garden crops, for which West Hartford is a shipping point. Steel balls are the chief local manufacture. The town was set off from Hartford in 1854. A residential suburb, it has grown rapidly in population in the last 20 years. It was the first town in Connecticut to adopt the Council-Manager form of government. Noah Webster, of dictionary fame, was born in West Hartford. Pop. 1920, 8,854; 1930, 24,941.

WEST HAVEN, a town of southern Connecticut, in New Haven Co., about 3 mi. south of New Haven, of which it is chiefly a residential suburb. It is served by an electric traction system and a steam railroad. Local manufactures include organs and metal goods. Savin Rock, on Long Island Sound near here, is a popular summer resort. West Haven was a separate borough within the town of Orange until 1910, when the borough was abolished. In 1921 it was chartered as a separate town. Pop. 1930, 25,808.

WEST HAZLETON, a borough of Luzerne Co. in eastern Pennsylvania, situated just west of Hazleton, 31 mi. southwest of Wilkes-Barre. There are anthracite coal mines in this section. Pop. 1920, 5,854; 1930, 7,310.

WEST INDIES, an extensive cluster of islands extending from Florida in the north to Venezuela in the south, circumscribed by the Atlantic Ocean and the Caribbean Sea. The archipelago, crescent in shape, comprises the Bahamas, the Greater Antilles, which includes Porto Rico, Haiti, Jamaica and Cuba, and the Lesser Antilles. The total area of the West Indies is about 100,000 sq. mi.

Aside from Cuba, Haiti and the Dominican Republic, which are independent states, and which by themselves embrace more than half the area and population, the West Indies are possessions of Great Britain, France, Holland and the United States. The total area of the British possessions is about 12,000 sq. mi. The British islands are scattered from the southeast coast of Florida to the northeast coast of Venezuela and include the British Bahamas, Jamaica, Turks Islands, Leeward Islands comprising Antigua, Barbuda, Redonda, Virgin Islands, Dominica, St. Kitts, Nevis, Anguilla and Montserrat, Windward Islands comprising Grenada, St. Vincent, the Grenadines, and St. Lucia, Barbados, Trinidad and Tobago. The French possessions are Martinique, Guadeloupe, part of St. Martin, Desirade, Marie Galante, St. Bartholomew and Les Saintes. The Dutch Islands are St. Eustatius, Saba, Aruba, Bonaire, Curaçao and part of St. Martin. The United States, which has owned Porto Rico since 1898, in 1917 purchased from Denmark for the sum of \$25,000,000 what are

now known as the American VIRGIN ISLANDS, which in the main are the islands of St. Thomas, St. John and St. Croix.

The British West Indies, with the exception of Jamaica, Barbados and the Bahamas, which enjoy a form of autonomy and have their own legislatures, are governed as crown colonies, being directly under the authority of the British Colonial Office. The Dutch possessions are likewise governed as crown colonies and have an even smaller share in administrative affairs. The French groups are administered by governors and local councils and have representatives in the French parliament. The United States Virgin Islands have a civil administration headed by a governor appointed by the President of the United States. Porto Rico has its local senate and house of representatives, but the governor is appointed by the President of the United States. Haiti and Cuba, like the Dominican Republic, have republican forms of government.

Fruit-growing, particularly bananas, pineapples, oranges, lemons and limes, is carried on throughout the West Indies. These, with sugar, cotton, coffee, cocoa and tobacco are the principal exports. The distillation of rum, especially in Jamaica, and the preparation of molasses are important industries. The cultivation of rubber is successfully carried on in St. Lucia and Trinidad. Pop. about 10,000,000.

WESTINGHOUSE, GEORGE (1846-1914), American inventor and electrical engineer, was born at Central Bridge, N.Y., Oct. 6, 1846. He was educated in the Schenectady, N.Y., public schools. In 1863-64 he served in the Union Army, and the following two years was an assistant engineer in the United States Navy. As a youth Westinghouse's natural bent for mechanics was developed in his father's machine-shop. His first invention was a device for replacing derailed coaches. In 1869 he obtained a patent for the air-brake and three years later patented the improved automatic air-brake, now employed by railroads throughout the world. In 1882 he organized the Westinghouse Electric and Manufacturing Co., at East Pittsburgh, Pa. He began the manufacture of direct-current lighting generators, alternating-current machinery and dynamos, among which were the first 10 used by the Niagara Falls power-plants, the New York City rapid-transit lines, and the London Metropolitan Railway. Later the firm, reorganized as the Westinghouse Electric International Co., produced pneumatic systems, turbines, generators and radio sets. Westinghouse's inventions outside the field of electrical engineering, and in addition to the aforementioned railroad appliances, include improvements in the internal combustion engine and a system of controlling natural gas and conveying it in pipe-lines for long distances. His important contributions to the safety and comfort of the civilized world were recognized by decorations from the French, Belgian and Italian governments. He was the second recipient of the John Fritz Medal. Westinghouse died at New York City, Mar. 12, 1914.

WEST LAFAYETTE, a city northwest of central Indiana, in Tippecanoe Co., situated 1 mi. northwest of Lafayette on the Wabash River. It is the seat of Purdue University. Ft. Quiatenon is nearby, and Tippecanoe Battleground is several miles northeast. Pop. 1920, 3,830; 1930, 5,095.

WESTMINSTER, CITY OF, the principal metropolitan borough of London, England, bounded on the north by Oxford Street and Bayswater Road, east by the City, south by the Thames and west by Chelsea, Kensington and Brompton. The borough includes the Abbey and St. George's parliamentary divisions. It became a borough in 1899. Westminster includes WESTMINSTER ABBEY, the Houses of Parliament, the Imperial Institute, Buckingham Palace, St. James's Palace, the Catholic Cathedral, Whitehall, the National Gallery and other noted public buildings. Pop. 1921, 141,578; 1931, 129,535.

WESTMINSTER, STATUTE OF, 1931. See BRITISH COMMONWEALTH OF NATIONS.

WESTMINSTER ABBEY, an abbey church in Westminster, London, England, officially the Collegiate Church of St. Peter. A matchless example of the EARLY ENGLISH style of architecture, this cruciform church consists of a nave with aisles, a transept with aisles, and a choir from which radiate seven chapels. The exterior length is 531 ft.; the breadth, at the transepts, 231 ft.; and the height of the nave 101 ft. It has been not only the coronation church of all English sovereigns except Edward V from the time of William the Conqueror, but also the burial place of many sovereigns and of scores of illustrious British men and women.

Two churches existed on the site of the present abbey, one built in 616 by King Sebert and the other in 985 by King Edgar, before Edward the Confessor consecrated, in 1065, his Norman church in Westminster. Between 1245 and 1265 Henry III largely rebuilt the Confessor's church, completing it as far as the fourth bay of the nave. The materials used were Caen stone and Purbeck marble, and the influence of the French cathedrals on the architectural style was marked. The western front of the original nave was rebuilt in 1367-88; Henry V's chantry was added in 1438; Henry VII's chapel in 1503; and before 1532 the vaulting of the nave had been completed by Abbot Islip. Late in the 17th century various restorations were effected by Sir Christopher Wren, who also designed the two western towers, finally erected in 1731-40 by N. Hawksmoor. Other restorations were made in the 19th century by Sir G. G. Scott, J. L. Pearson and J. T. Michlethwaite.

Of greatest interest inside the abbey are the Royal Chapels; the superb fan-vaulted Chapel of Henry VII, since 1725 the chapel of the Order of the Bath; Edward the Confessor's Chapel, containing the Coronation Chairs and the Stone of Scone; the Poets' Corner, in the east aisle of the south transept, containing tombs and busts of celebrated English authors; and, in the middle of the nave, the Tomb of the Unknown Soldier, dating from 1920.

The conventual buildings of the abbey monastery, dissolved in 1539, include: the Chapter House, 1253; Cloisters, rebuilt in 1298; Little Cloisters, 14th century; Chapel of the Pyx, once a treasury, and the Norman Undercroft.

WESTMINSTER COLLEGE, at New Wilmington, Pa., a coeducational institution controlled by the United Presbyterian Church. It was founded in 1852 as Westminster Collegiate Institute. The name was changed to Westminster College in 1887. The productive funds in 1931 amounted to \$853,487. The library contained 10,000 volumes. In 1931-32 there were 526 students, and a faculty of 28, headed by Pres. W. Charles Wallace.

WEST MONROE, a city in Ouachita Parish, northern Louisiana, situated on the Ouachita River, two mi. west of Monroe. It is served by the Yazoo and Mississippi Valley Railroad. The city has oil refineries and paper mills. Pop. 1920, 2,240; 1930, 6,566.

WESTMOUNT, a residential city of Hochelaga Co., Quebec, Canada, situated near the St. Lawrence River, and now surrounded by the city of Montreal although preserving its municipal independence. It is without manufactures. Pleasantly laid out, Westmount contains one of the oldest houses in the vicinity, the Hurtubise home erected in 1675, and also has numerous churches and parks. Founded in 1874, it was incorporated as a city in 1908. Pop. 1921, 17,593; 1931, 24,235.

WEST NEW YORK, a rapidly growing town of Hudson Co., N.J., situated partly on the top of the Palisades and partly on level ground along the Hudson River opposite midtown New York and adjoining Union City and Weehawken on the north. Its transportation facilities include electric trolleys and motor bus lines with direct connections to both the Weehawken and Edgewater ferries. It is also served by the West Shore and New York, Ontario and Western railroads from the Weehawken station; it is centrally located between the Holland Tunnel and George Washington Bridge. West New York is the residence of many New York workers and has a great number of varied industries, the most important of which are the manufacturing of silks and embroideries. Its products were valued at about \$16,000,000 in 1929. Pop. 1920, 29,926; 1930, 37,107.

WESTON, a town in Middlesex Co., eastern Massachusetts, situated 12 mi. west of Boston. It is served by the Boston and Maine and the Boston and Albany railroads, and is an independent branch of the Boston post office. The town is chiefly residential. Established as a part of Watertown in 1630, Weston was separately incorporated in 1713. Pop. 1920, 2,282; 1930, 3,332.

WESTON, a city in northern West Virginia, the county seat of Lewis Co., situated on the west fork of the Monongahela River, 25 mi. southwest of Clarksburg. The Baltimore and Ohio Railroad serves the city. Weston lies in the Blue Grass region, a rich farming and dairying section with extensive coal

mines, wooded areas and gas and oil deposits. The local manufactures are glassware and lumber products. "Stonewall" Jackson lived as a boy 5 mi. below Weston, where the state Four-H camp is now located. Pop. 1920, 5,701; 1930, 8,646.

WESTON-SUPER-MARE, a seaside resort of Somersetshire, England, lying on the Bristol Channel about 137 mi. southwest of London. It is situated upon level ground near the shore and, to the north and east, upon the slopes of sheltering Worlebury Hill. Essentially modern, it owes its popularity to the fact that it is a resort-suburb of both Bristol and Cardiff. An esplanade runs some 2 mi. in length, and there are public gardens, two piers, a museum opened in honor of Queen Victoria's Diamond Jubilee, and a sanatorium with winter gardens. Intermittent springs are affected by the ebb and flow of the tide, and the bathing at lowest tide is poor because of an expanse of iodine mud between the beach and the water. In addition to its resort activities, Weston has long been known for its potteries and fisheries. Pop. (of district and town) 1921, 31,643; 1931, 28,555.

WEST ORANGE, a town of Essex Co., N.J., located 6 mi. west of Newark. It is situated partly in a valley and partly on a steep slope rising to a maximum of 600 ft. It has many fine residential districts, and is served by the Erie Railroad, electric trolleys and motor bus lines. The most important of its industries, the products of which were valued approximately at \$10,000,000 in 1929, include the various Thomas A. Edison enterprises. The retail trade in 1929 amounted to \$5,372,198. Here also are located the Edison Laboratories which are visited annually by people from all over the world. Created as the township of Fairmount in 1862, West Orange was incorporated as a town in 1900. Pop. 1920, 15,573; 1930, 24,327.

WEST PALM BEACH, a city on the southeastern coast of Florida, the county seat of Palm Beach Co., situated on Lake Worth, a part of the East Coast Canal inland waterway system. It is connected by bridges and ferries with Palm Beach, and is served by two railroads, airplanes, steamships and buses. The city is a fashionable winter resort and trade center. It has commercial fisheries, lumber mills, and novelty and furniture factories. The retail trade in 1929 amounted to \$21,711,230. West Palm Beach was settled prior to 1892 and incorporated in 1893. Pop. 1920, 8,659; 1930, 26,610.

WESTPHALIA, a province of Prussia, Germany, bounded on the west by the Netherlands, on the south by Rhenish Prussia and on the north by Hanover; area 7,803 sq. mi. The capital is MUNSTER. Although Westphalia is fairly level in the northwest, the surface is hilly or mountainous in other parts of the country. The area is rich in minerals and is one of the world's leading coal fields. Iron, zinc and copper are mined in large quantities, and stone and slate are extensively quarried. Westphalia is also an important industrial district, manufacturing iron and

steel goods, textiles (especially linen), paper and glass. Crop lands are widely cultivated and produce grain, potatoes and other vegetables, flax and fruit. In the towns of Munster and Osnabrück the treaties were signed which brought the THIRTY YEARS' WAR to an end. (See WESTPHALIA, TREATY OF.) In 1807 Napoleon established the Kingdom of Westphalia for his brother Jerome, but this was dissolved after the Battle of Leipzig in 1813. Pop. 1925, 4,811,219.

WESTPHALIA, TREATY OF (1648), the name given the treaties of Münster and Osnabrück which closed the THIRTY YEARS' WAR. The treaty was twofold, religious and political. In religious matters it confirmed the TREATY OF AUGSBURG of 1555, extending it to the Calvinists. Except in the hereditary Hapsburg lands it bound the princes to allow at least private freedom of worship and tended to perpetuate the religious *status quo* by providing that a prince who changed his confession lost his lands. On the political side the treaty was the death warrant of Papal temporal power in Germany and of the Holy Roman Empire. Papal vetoes, not by name but in fact, were declared void. The power of the Empire was continued only as a fiction, the old diet lost all its powers, and the 300-odd German princes were recognized as *de facto* sovereigns. France and Sweden both gained territorial advantages. The former secured the bishoprics of Metz, Toul and Verdun, and the ambiguous Austrian, but not the Imperial, rights in Alsace. Sweden received large lands south of the Baltic and coast ports on the North Sea. Both these powers were made guarantors of the peace and thus obtained a legal right to interfere in German affairs. The Electorate of Brandenburg, the future Prussia, was greatly increased. The independence of Switzerland and the Netherlands was recognized.

WEST PITTSBURGH, a borough of Luzerne Co., northeastern Pennsylvania, situated across the Susquehanna River from Pittston, 8 mi. northeast of Wilkes-Barre. It is served by the Delaware, Lackawanna and Western Railroad. The Wyoming Valley Airport is 3 mi. south. Coal mining is the chief local industry; there are several manufacturing plants. Ft. Jenkins, used during the Revolution, is a landmark. West Pittston was founded in 1857. Pop. 1920, 6,968; 1930, 7,940.

WEST POINT MILITARY ACADEMY. See UNITED STATES MILITARY ACADEMY.

WESTPORT, a town and village in Bristol Co., southeastern Massachusetts. The village is situated on the Westport River, seven mi. southeast of Fall River and about equally distant from New Bedford. The town, adjoining Fall River on the north, is bounded on the south by the Atlantic Ocean, and has a fine strip of shore, known as Horseneck Beach. Vegetables, milk and poultry are leading interests. The chief local manufactures are cotton products. There is considerable fishing. Westport was separated from Dartmouth and incorporated as a town in 1787. The Waite-Potter house, built about 1677, is an interesting landmark. Pop. 1920, 3,115; 1930, 4,408.

WEST RIVER, the river in South China called by the Chinese the Si KIANG. West River is simply the translation of the Chinese name.

WEST SPRINGFIELD, a town in Hampden Co., southwestern Massachusetts, situated on the west bank of the Connecticut River. It is a division center on the Boston and Albany Railroad. The town is largely industrial, manufacturing chiefly paper, gas pumps, magnetoes, steel gears, and wooden and fiber boxes. The manufactured output, 1927, was worth \$15,964,435. The retail business in 1929 amounted to \$4,835,517. West Springfield received its charter of incorporation as a town in 1774. Pop. 1920, 13,443; 1930, 16,684.

WEST VIEW, a borough of southwestern Pennsylvania, in Allegheny Co., situated about 5 mi. from Pittsburgh, with which it is connected by street car lines. The borough is in healthful surroundings and is chiefly a residential district. It was incorporated in 1905. Pop. 1920, 2,797; 1930, 6,028.

WEST VIRGINIA, a South Atlantic State of the United States, sometimes called the "Panhandle State." It is situated between 37° 10' and 40° 40' N. lat. and 77° 40' and 82° 40' W. long. It is



WEST VIRGINIA STATE SEAL

bounded on the northwest by Ohio from which it is separated by the Ohio River; on the north by Pennsylvania and Maryland, being divided from the latter by the Potomac River; on the east and southeast it is bounded by Pennsylvania, Maryland and Virginia, and on the southwest by Virginia and Kentucky, the Big Sandy River separating it from the latter state. West Virginia comprises an area of 24,170 sq. mi., inclusive of 148 sq. mi. of water surface. The state is irregularly oval in shape, with a maximum length of 240 mi. from north to south and an extreme breadth of 265 mi. from east to west. In size West Virginia ranks fortieth among the states of the Union.

Surface Features. The greater part of West Virginia lies within the Allegheny plateau, between the Allegheny front on the east and the Ohio River on the west. It is a broad, west-sloping area, intricately dissected by the numerous tributaries of the Ohio. The largest of these, the Kanawha, flows in a gorge almost 1,000 ft. below the plateau surface. Other important streams are the Guyandot, Little Kanawha, and Monongahela which is a headstream of the Ohio. The horizontal strata of the plateau consists chiefly of limestone, sandstone, shale and extensive seams of coal.

The arm of the state extending eastward between Maryland and Virginia takes in a number of the Allegheny ridges and part of the Great Appalachian valley, locally known as the Shenandoah valley. Spruce Knob, 4,860 ft. high, in Pendleton Co., is the highest point in the state. The lowest is 240 ft. on

the Potomac River in Jefferson Co., and the mean elevation is 1,500 ft. above sea level.

Climate. Due to its high altitude the climate of West Virginia is generally bracing and pleasant. The mean annual temperature is 52.7° F., ranging for the winter months from an average of 26° F. in the north-eastern mountains to 34° F. along the Ohio River and for the summer months from 67° F. to 74° F. in the same districts. The average annual precipitation is 43.6 in., but it is greatest in the mountains. At Parkersburg, on the Ohio, the average date for the last killing frost in spring is April 16 and that of the first killing frost in autumn is October 16, giving an average growing season of 183 days.

Forests and Parks. West Virginia was once a famous forest state. Practically its entire land area was covered with excellent stands of hard and soft-woods, but only 250,000 acres of virgin forest remain and in a 1931 estimate something over 60% or 9,213,015 acres are potential forest land. One million acres of this total are now merchantable timber land and the balance consists of cut-over lands and farm wood lots. On the mountains and high plateaus red spruce, found in pure stands above 3,500 ft. and originally covering over 1,500,000 acres, hemlock, yellow birch and some balsam fir are the characteristic species; at the lower altitudes chestnut, oak, hickory, maple, walnut, black gum, sassafras, red bud, yellow poplar, Virginia scrub pine and short leaf pine are found. State forests cover 16,000 acres. They are used as game preserves and are stocked with deer, grouse, turkey and squirrel but have no recreational developments. Sections of the Monongahela and Shenandoah National Forests with a total net area of 278,371 acres extend into the state.

Minerals and Mining. Mining is the chief industry of the state. For several decades West Virginia has been a leading producer of coal, being surpassed only by Pennsylvania in output of bituminous coal, mining since 1925 about one-fourth of the total tonnage produced in the United States. About 1880 West Virginia became one of the foremost producers of petroleum. After 1900 the yield largely declined, but the state continued to lead in value of natural gas produced.

With mineral productions in 1929 amounting to \$346,564,746, West Virginia stood fifth among the states, ranking first in natural gas, second in coal, third in bromine, fourth in natural gasoline and lime, eighth in limestone and ninth in petroleum. The leading product was coal, 138,518,855 tons, valued at \$215,110,000. Second in importance was natural gas, 167,323,000 M cu. ft., \$73,793,000, together with petroleum, 5,574,000 bbls., \$20,070,000; and natural gasoline, 72,994,000 gals., \$6,285,000. Other major products in order of value were clay products, \$20,490,255; limestone, \$3,507,603; sand and gravel, 2,667,940 tons, \$2,893,542; and lime, 308,600 tons, \$1,865,531.

During 1929 891 mines and quarries gave employment to 106,747 persons who received \$141,337,218 in salaries and wages; of these 104,349, or about 98%, were engaged in the coal mining industry.

Soil. The valleys and bottom lands of the larger streams contain the richest soils in West Virginia. Those of the Ohio valley consist of glacial drift material which the river and its branches have accumulated on their course. In the flood plains of many other streams are soils made up of clays, sands, and alluvium which are notable for their fertility. Generally the soils in the western part of the state consist largely of decomposed red shales containing lime and of red clays possessing marl. These soils are fertile as are also those of northeastern West Virginia which are derived chiefly from decomposed limestone. In the higher regions of the mountains there is but little cultivation of crops because of the poor quality of the soil.

Agriculture. Corn, hay, potatoes, vegetables and fruit constitute the principal crops.

In 1930 8,802,348 ac. or 57.3% of the entire land area was in farms, 82,641 in number, with an average size per farm of 106.5 ac. and an average value per acre of \$38.85. Of the farm area 1,907,294 ac. was crop land; 4,510,673 ac., pasture land; and 2,007,939 ac., woodland. The total value of farm property was \$411,787,511, of which \$341,976,394 was represented by land and buildings; \$15,267,497, by implements and machinery; and \$54,543,620, by domestic animals.

According to the census of 1930 West Virginia produced in 1929 field crops to the value of \$51,850,490, ranking thirty-seventh among the states. It stood fourth in buckwheat and seventh in apples. The chief crops were grains valued at \$16,065,143; vegetables, \$13,719,193; hay and forage, 744,480 tons, \$11,531,939; fruits and nuts, \$9,283,321, and tobacco, \$1,125,957. The grains included corn 11,656,200 bu., oats 1,514,150 bu., and wheat 1,360,285 bu. The leading vegetable crop was potatoes, \$5,216,152. The chief fruits were apples 5,716,495 bu., and peaches 488,715 bu. Farm products sold by cooperative marketing rose from \$284,150 in 1919 to \$1,207,106 in 1929. Farm machinery and equipment in 1930 included 36,978 automobiles, 7,432 motor trucks, 2,792 tractors, 1,269 electric motors, and 4,314 stationary gas engines.

Animal Industry. Cattle-raising is the chief livestock interest. According to the census of 1930 West Virginia ranked thirty-fourth among the states in total value, \$54,543,620, of domestic animals on farms. Among these were 556,257 cattle reported from 71,240 farms or 86% of all farms in the state and valued at \$29,885,681; horses, 112,638 in number valued at \$10,096,458; mules, 12,320, \$1,139,087; sheep, 896,661, \$7,186,163, and swine, 221,681, \$2,542,111.

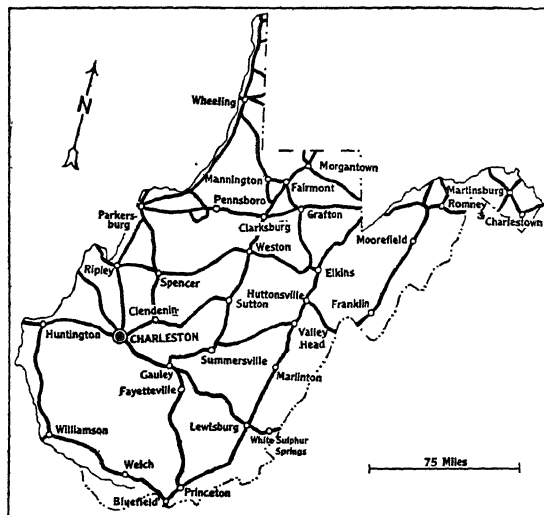
Of the cows on farms, 215,753 were kept mainly for milk production and 50,790 mainly for beef production. In 1929, 83,868,465 gals. of milk were produced; the total value of dairy products sold was \$8,438,706. The poultry raised, with a value of \$5,643,356, included chickens, 5,503,780 in number valued at \$4,927,597, and turkeys, 182,522, \$636,620. The chickens sold, 2,442,994 in number, were valued at \$2,317,664. Of 27,929,598 doz. chicken eggs produced, valued at \$8,982,770, 19,644,672 doz., with a

value of \$6,307,914, were marketed. The wool clip, 2,741,308 lbs., was valued at \$995,441. Honey, amounting to 803,556 lbs. valued at \$198,403, was produced from 94,313 hives.

Fisheries. There are no commercial fisheries in the state, and little game fishing. In 1930, the state issued 189,000 fishing licenses and received \$70,000 in fees. One fish hatchery was operated at a cost of \$20,000, putting out 986,500 trout and 22,500 bass. Plantings in state waters by the U.S. Bureau of Fisheries included 773,660 brook trout, 341,000 rainbow and loch leven trout, 132,000 bass and 980,465 perch.

Transportation. The Ohio River, which forms the state's northwestern boundary, is navigable for large boats, while its tributaries, the Kanawha and the Little Kanawha rivers afford transportation to boats not over 3 ft. in draught. Railway mileage has been maintained in spite of adverse circumstances. Despite the rapid growth of highway and trucking facilities, which supplement the railroad service, the region's requirements for the transportation of coal and lumber remain unsatisfied. In 1930 the total steam railway mileage was 4,006, with the Baltimore and Ohio, the Chesapeake and Ohio, the Norfolk and Western and the Western Maryland the chief systems.

Expanding rapidly, the highway system showed a total mileage of 39,249 on Jan. 1, 1930, which included 4,450 mi. of surfaced roads and 2,734 mi. of



WEST VIRGINIA STATE ROADS

improved state highways. During 1929, highway expenditures were \$28,036,087, of which \$15,872,417 was paid by the state and \$12,163,670 by county and local governments. Gasoline consumption during 1930 aggregated 140,411,000 gals. The state gasoline tax produced an income of \$5,367,078 in 1930 as against \$2,922,675 in 1926. Motor vehicle registrations were 266,273 in 1930 compared with 217,589 in 1925. The growth of transportation by truck is indicated by registrations, which rose from 27,332 in

1925 to 40,373 in 1930, or nearly 50%. The number of buses in operation increased from 814 to 884 during the same period.

Manufactures. The manufactures of West Virginia, which increased 165% in value from 1914 to 1929, are based chiefly on the state's extensive mineral and forest resources.

According to the Census of 1930 West Virginia with manufactures for 1929 valued at \$513,012,300 stood twenty-sixth among the states, ranking second in glass, third in pottery, sixth in iron and steel rolling mill products and ninth in steam railway carshop construction. Its 1,488 establishments gave employment to 8,239 officers and employees, who received \$20,996,351 in salaries, and to 85,326 wage earners, who were paid \$115,294,705 in wages. These factories used a total of 650,199 horse power, expended \$28,246,595 for fuel and power, and \$233,151,191 for material and supplies, and added by the process of manufacture \$251,614,514 to the value of their output.

In this output there were 52 separately enumerated industries. The major manufactures, with their value, were iron and steel rolling mill products, \$93,869,519; glass, \$48,384,942; steam railway carshop construction, \$33,518,553; lumber, \$23,325,903; chemicals, \$22,858,635; petroleum refining, \$17,268,590; pottery (including porcelain ware), \$15,707,704; leather, \$14,354,329; bread, \$11,005,655, and coke, \$9,952,334.

The leading manufacturing cities with value of output were Wheeling, \$53,389,126; Clarksburg, \$16,302,189; Parkersburg, \$16,292,200; Charleston, \$16,263,409; Fairmont, \$12,821,423, and Martinsburg, \$10,584,730.

Commerce. According to the census of 1930, there were in 1929 1,132 wholesaling establishments in West Virginia, with total sales of \$346,838,887. These organizations gave full-time employment to 10,339 men and women whose annual salaries and wages aggregated \$19,302,996. The chief distributing centers are Charleston and Huntington.

The total sales of the 17,283 retail stores amounted to \$442,119,101. Sales per store averaged \$25,581; sales per capita were \$255.68.

CHIEF RETAIL DISTRIBUTING GROUPS

Group	No. of Stores	Sales	% of Total
General Mdse.	4,319	\$142,009,116	32.11
Automotive	2,644	83,768,711	18.95
Food	4,620	82,254,958	18.60
Apparel	1,057	35,666,186	8.07
Lumber & Bldg.	631	23,796,894	5.40
Furn. & Household ..	411	20,208,961	4.56
All other stores	3,601	54,414,275	12.31
Total, all stores ...	17,283	\$442,119,101	100.00

Finance and Banking. The assessed value of all taxable property in 1928 was \$2,095,430,997. The total bonded debt in 1930 was \$78,738,700. Total state revenues in 1929 were \$23,631,783; total disbursements, \$23,734,719. The chief sources of income were property taxes, \$5,303,120 and licenses, \$14,107,110. This item included taxes on corporations,

insurance companies, motor vehicles and gasoline sales, \$4,463,860. The principal payments were for highways, \$8,561,704, education, \$1,902,290 and debt service, \$2,627,927.

There were 273 banks in West Virginia in 1930. Of these, 109 were national banks and 164 trust companies and state banks. Their total capitalization was \$30,963,100; their surplus and undivided profits, \$34,499,000. Total resources were \$415,821,000, with loans and discounts aggregating \$263,684,000. Demand and time deposits totaled \$311,461,000. Per capita demand and time deposits were \$180.04; per capita savings deposits, \$86.95. The total savings of \$150,417,000 were owned by 373,842 depositors. The aggregate national bank circulation was \$10,153,000.

Government. The legislative body of West Virginia consists of a Senate composed of 30 members and a House of Delegates of 94 members, the former elected for terms of four years and the latter for terms of two years. They meet in biennial sessions limited in duration to 60 days. The chief executive is the governor elected for a term of four years but ineligible for reelection. He receives a salary of \$10,000 a year. Other executive officers are the secretary of state, superintendent of free schools, auditor, treasurer, attorney-general, and commissioner of agriculture. Judicial power is vested in a supreme court of appeals, circuit courts, and inferior courts. The supreme court consists of five judges elected for terms of twelve years at salaries of \$8,000 per year.

Social Welfare Institutions. A Board of Control supervises the state institutions, but the governor appoints the director of each. A State Board of Children's Guardians looks after dependent and neglected children. There is an industrial school for white boys at Pruntytown and for colored boys at Lakin. The industrial school for white girls is at Industrial, and an industrial home for colored orphan girls is at Huntington. A children's home is at Elkins and a home for aged and infirm colored men and women at Huntington. Schools for white deaf and blind are at Romney and for colored at Institute. State hospitals are located at Weston, Spencer, Huntington, Welch, McKendree, Fairmont and Lakin. There is a state sanitarium at Beckley and a tuberculosis sanitarium for whites at Hopemont and for colored at Denmar. The penitentiary is at Moundsville. In 1929 a site at St. Mary's was selected for a training school.

Education. The first schools were organized while West Virginia was part of the state of Virginia, and as late as 1860 only three West Virginia counties had organized schools. The schools of Shepherdstown date from 1846, and those of Wheeling from 1849. The first school law, enacted in 1863, provided for the establishment of free schools. In 1928 there were 7,159 public school buildings in the state, with 357,178 enrolled pupils in the public kindergartens and elementary schools, and 44,598 pupils in the public secondary schools. All children from

7 to 14 years of age are required by law to attend school 160 days each year.

The number of persons from 5 to 20 years of age attending school in 1930 was 413,581, or 66.6% of the population within the ages specified, as compared with 321,191, or 62.3%, in 1920. The number of persons, 10 years and over, unable to read and write in 1930 was 62,492, or 4.8%, as compared with 69,413, or 6.4%, in 1920.

Among the institutions of higher learning maintained by the state are the West Virginia University at Morgantown; normal schools at Huntington, Fairmont, Athens, Glenville, West Liberty and Shepherdstown; and for Negroes, Bluefield Colored Institute at Bluefield, and West Virginia State College at Institute. The more widely known of the private educational institutions are Bethany College at Bethany, West Virginia Wesleyan College at Buckhannon, Davis and Elkins College at Elkins, and Morris Harvey College at Barboursville.

Population. In 1930 West Virginia ranked twenty-seventh among the states with a population of 1,729,205 or an average of 72.0 per sq. mi., an increase of 265,504 or 18.1% from 1920. The population rose from 442,014 in 1870 to 958,800 in 1900, 1,221,119 in 1910, and 1,463,701 in 1920. In 1930 there were 1,613,934 or 93.3% whites and 114,893 or 6.6% Negroes, an increase from 1920 of 17.2% whites and 33.8% Negroes. Of the whites, 1,562,414 were native-born and 51,520 were foreign-born. The rural population was 1,237,701 or 71.6% of the total, an increase of 143,007 or 13.1% from 1920; the urban population was 491,504 or 28.4% of the total, an increase of 122,497 or 33.2% since 1920. In 1930 the six largest cities were Huntington, 75,572; Wheeling, 61,659; Charleston, 60,408; Parkersburg, 29,623; Clarksburg, 28,866; Fairmont, 23,159.

Occupations. In 1930 570,452 persons, or 33% of the population, were gainful workers 10 years old or older; 85.6% of these were males and 14.4% were females; 86.1% were native white; 5.6% foreign-born white, and 8.3% Negro. Among the chief occupations, with number of workers, were manufacturing, 133,698, including 32,029 factory operatives, and 27,071 factory laborers; agriculture, 118,200, including 69,862 farmers and 29,926 farm wage workers; mining, 109,923, of which 97,521 were coal mine operatives; trade, 50,267, including 15,541 retail dealers and 17,096 salespersons; transportation and communication, 46,899; domestic and personal service, 41,123; professional service, 34,864, including 16,402 school teachers, 4,728 men and 11,674 women; clerical service, 24,833, and forest industry, 5,203.

HISTORY

The first expedition on record across the Blue Ridge Mountains, in 1670, headed by Thomas Batts, found indications that frontiersmen had preceded it. In the 17th century fur traders frequently visited the upper Potomac valley, and doubtless some visited the Kanawha. The Virginia rangers, the frontier militia,

occasionally penetrated the wilderness. Before 1730 a few cabins were clustered at Shepherdstown, built by Germans from Pennsylvania. Earliest settlement favored the creeks flowing into the Potomac, which river in 1736 was traced to its source. Christopher Gist explored the western part of the state in behalf of the OHIO COMPANY, and the region was included in the projected colony of VANDALIA. Meanwhile the wave of Scotch-Irish and German settlement in the Appalachian valley had lapped into West Virginia. The westward movement was interrupted and outlying settlements were made untenable by the FRENCH AND INDIAN WAR; in 1774, at the outbreak of the Indian War, settlement was again temporarily stopped, but in the interim the Monongahela, Greenbriar, and New River valleys were populated and the line of cabins along the Great Kanawha stretched toward the Ohio. At the beginning of the Revolutionary War about 30,000 settlers occupied the West Virginia region.

Democratic, opposed to slavery, and economically and socially unlike eastern Virginia, the western section became united in consistent opposition, but was hopelessly outweighed in legislative strength. The region voted overwhelmingly against the Virginia ordinance of secession in 1861. In that year a convention of loyal members of the legislature met at Wheeling on June 11, declared vacant the offices of those in the Virginia government who had supported secession, and a second convention formed a reorganized government of Virginia. After a popular vote had endorsed separate statehood by 18,489 votes to 781 and a state constitution was ratified in April, 1862, the reorganized government fulfilled the purpose of its existence by consenting to the separation. Having met the condition, imposed by Congress, that there be a constitutional provision for gradual abolition of slavery, West Virginia was proclaimed a state on June 20, 1863. The state contributed about 29,000 men to the Union armies, but perhaps 10,000 of its citizens fought with the Confederate forces. After the Civil War demand for timber, oil, and coal encouraged phenomenal industrial development, made possible by the rapid extension of railway lines. The coming of capital and labor from the northern states overthrew the Democratic control of state politics in 1897, and until 1917 the Republicans were dominant. Since that year neither party has maintained a consistent majority. In the Presidential election of 1932, West Virginia returned a vote for Franklin D. Roosevelt, and in the gubernatorial election of the same year placed H. G. Kump in office.

BIBLIOGRAPHY.—V. A. Lewis, *History of West Virginia*, 1913; J. M. Callahan, *History of West Virginia, Old and New*, 1923.

WEST VIRGINIA UNIVERSITY, a state controlled, coeducational institution at Morgantown, W. Va. An outgrowth of the Woodburn Seminary which had existed for half a century prior to the founding of the university, it was chartered in 1867 by the state legislature as a land grant college. It was first known as the Agricultural College of West

Virginia, but in 1868 the name was changed to West Virginia University. It comprises colleges of Arts and Science, Law, Engineering and Agriculture; schools of Music, Medicine and Pharmacy, and Graduate and Summer Schools. The productive funds in 1931 amounted to \$2,350,000. The library contained 105,000 volumes. In 1931-32 there were 3,350 students and a faculty of 241 headed by Pres. John R. Turner.

WESTWARD HO!, a thrilling romance of Elizabethan sailors and buccaneers, by CHARLES KINGSLEY; published 1855. The hero of this exciting tale is Amyas Leigh, a young English sailor who, after many harrowing adventures on the Spanish Main, abandons his pursuit of his first love, Rose Salterne, who has eloped with Don Guzman, a Spaniard, and finally, after being blinded in the fierce battle of the Armada, returns home and marries the daughter of John Oxenham, the bewitching Ayacanora, whom he has found among the Peruvians.

WEST WARWICK, a town of eastern Rhode Island, about 12 mi. from Providence, and served by the New Haven Railroad. Potatoes, corn and hay are produced in the surrounding region, and there are large cotton mills. In 1929 the output of manufactures was valued approximately at \$15,000,000; the retail trade amounted to \$5,882,946. The town was organized in 1913. Pop. 1920, 15,461; 1930, 17,696.

WEST YORK, a borough of southeastern Pennsylvania, in York Co., situated on the Western Maryland and Pennsylvania railroads, and on bus lines. It adjoins the city of York, with which it is connected by street cars. West York is primarily in an industrial district and manufactures furniture, roofing materials and pottery. It was incorporated in 1904. Pop. 1920, 3,320; 1930, 5,381.

WETHERSFIELD, a town in central Connecticut, in Hartford Co., situated 3½ mi. south of Hartford on the Connecticut River. The New Haven Railroad, trolley and bus lines serve the town. Wethersfield was settled in 1634, by John Oldham and a few adventurers from Massachusetts. For 100 years the town was the head of navigation on the Connecticut River, and was a port for ships from all parts of the world. Ship building was a thriving industry until about 1878. The town has many interesting landmarks, among them, Webb House where Washington and Rochambeau visited; the First Church of Christ (Congregational), and a great elm tree, called "Largest Elm Tree." The town is a beautiful residential settlement, a popular suburb of Hartford. Pop. 1920, 4,342; 1930, 7,512.

WETTER, Vetter or Vatter, large lake of southern Sweden, extends for 82 mi. along a deep valley, with its surface 290 ft. above sea level. It has a maximum breadth of 18 mi., an area of 730 sq. mi. and a maximum depth of 400 ft. Water of an exceptional blueness and clearness flows between shores which are rugged and wild. Small rivers and numerous springs feed the lake, which is subject to sudden changes in level, high waves and heavy storms. Its outlet, the

Motala River, connects Wetter with the Baltic Sea and a canal gives it communication with Lake Wener. JÖNKÖPING, in the south, is a leading manufacturing center.

WEWOKA, the county seat of Seminole Co., eastern central Oklahoma, situated 58 mi. southeast of Oklahoma City. It is served by the Chicago, Rock Island and Pacific Railroad. Oil and natural gas are the leading interests of the vicinity. An abundance of cotton, corn and small grain are raised in this district. The retail trade in 1929 reached a total of \$6,832,861. Pop. 1920, 1,520; 1930, 10,401.

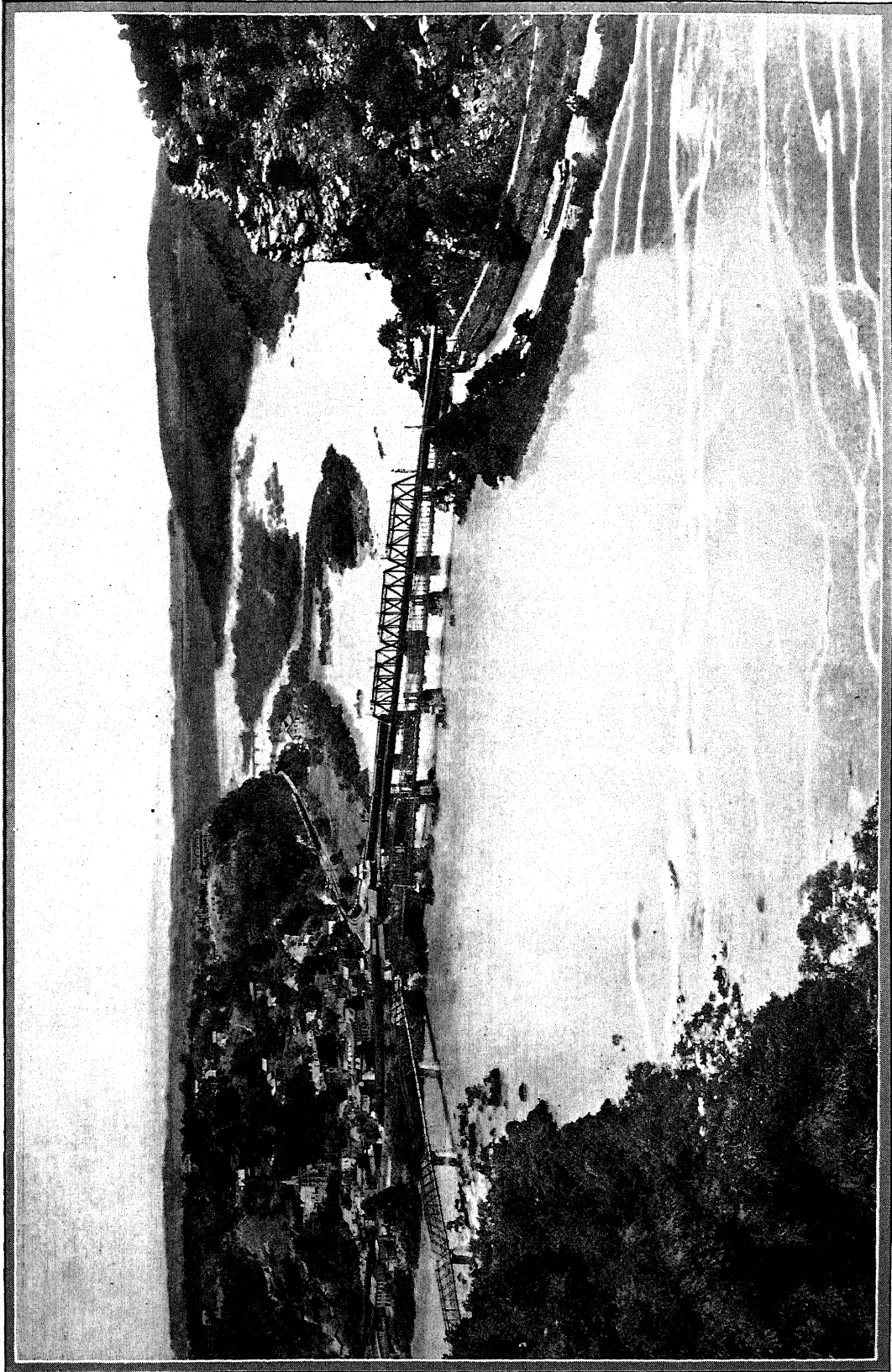
WEXFORD, a county of the Irish Free State, bounded by counties Wicklow, Waterford, Kilkenny and Carlow, and on the south by St. George's Channel. Covering about 576,700 acres of rolling country, the soil ranges from clay to rich alluvial mould. The east coast is unsafe, and only two harbors afford safe anchorage. Hills mark the south, and the Slaney and Barrow are the principal rivers. Created a county by King John, Wexford was active in the rebellions against the English. There are many Danish hill forts, monastic remains and old castles. Potatoes and grains are staple crops; cattle are raised. Manufactures are of local importance. Small fishing villages cluster along the southern coast. Pop. 1926, 95,848.

WEYMAN, STANLEY JOHN (1855-1928), English novelist, was born at Ludlow, Shropshire, Aug. 7, 1855, and educated at Shrewsbury School, and at Christ Church, Oxford. He practiced law for 8 years. His romantic novels are based largely on French history, and include *A Gentleman of France*, 1893, *Under the Red Robe*, *Memoirs of a Minister of France*, *Sophia*, *The Abbess of Vlaye*, *The Wild Geese*, *The Great House*, 1919, *Ovington's Bank*, 1922, and *Queen's Folly*, 1925. Weyman died at Rutham, Wales, Apr. 10, 1928.

WEYMOUTH, a town of Massachusetts, comprising four islands and the peninsula between the Weymouth Fore and the Weymouth Back rivers, 11 mi. southeast of Boston. Traffic on the two rivers averages 1,000,000 tons annually, valued at about \$9,000,000. The leading manufactures are shoes and chemicals. In 1929 the factory output amounted to about \$13,000,000; the retail trade amounted to \$5,475,460. A United States naval magazine is located on Weymouth Back River. The town was incorporated in 1635, from the plantation of Wessagusset, which was settled in 1622. Pop. 1920, 15,057; 1930, 20,882; 82% native white.

WEYMOUTH and MELCOMBE REGIS, a seaport and watering-place of Dorsetshire, England, on the Wey, and upon a promontory extending into Weymouth Bay, 142 mi. southwest of London. The two towns, lying diagonally across the river from each other, were amalgamated in 1571 to settle commercial disputes. Important in Roman and Saxon times, Weymouth's popularity as a spa began in 1789 with the patronage of George III. Sir Christopher Wren represented the town in Parliament, and it was the port of sail for Gov. John Endicott when he set

WEST VIRGINIA



EWING GALLOWAY PHOTO

HARPER'S FERRY, WEST VIRGINIA, THE MEETING PLACE OF THREE STATES

At the left, Harper's Ferry, the scene of the Abolitionist activities of John Brown, lies in the hills of West Virginia. The Baltimore & Ohio Railroad bridge over the Potomac connects the town with Maryland, at the right, while in the lower left of the photograph Virginia extends along the Shenandoah River.

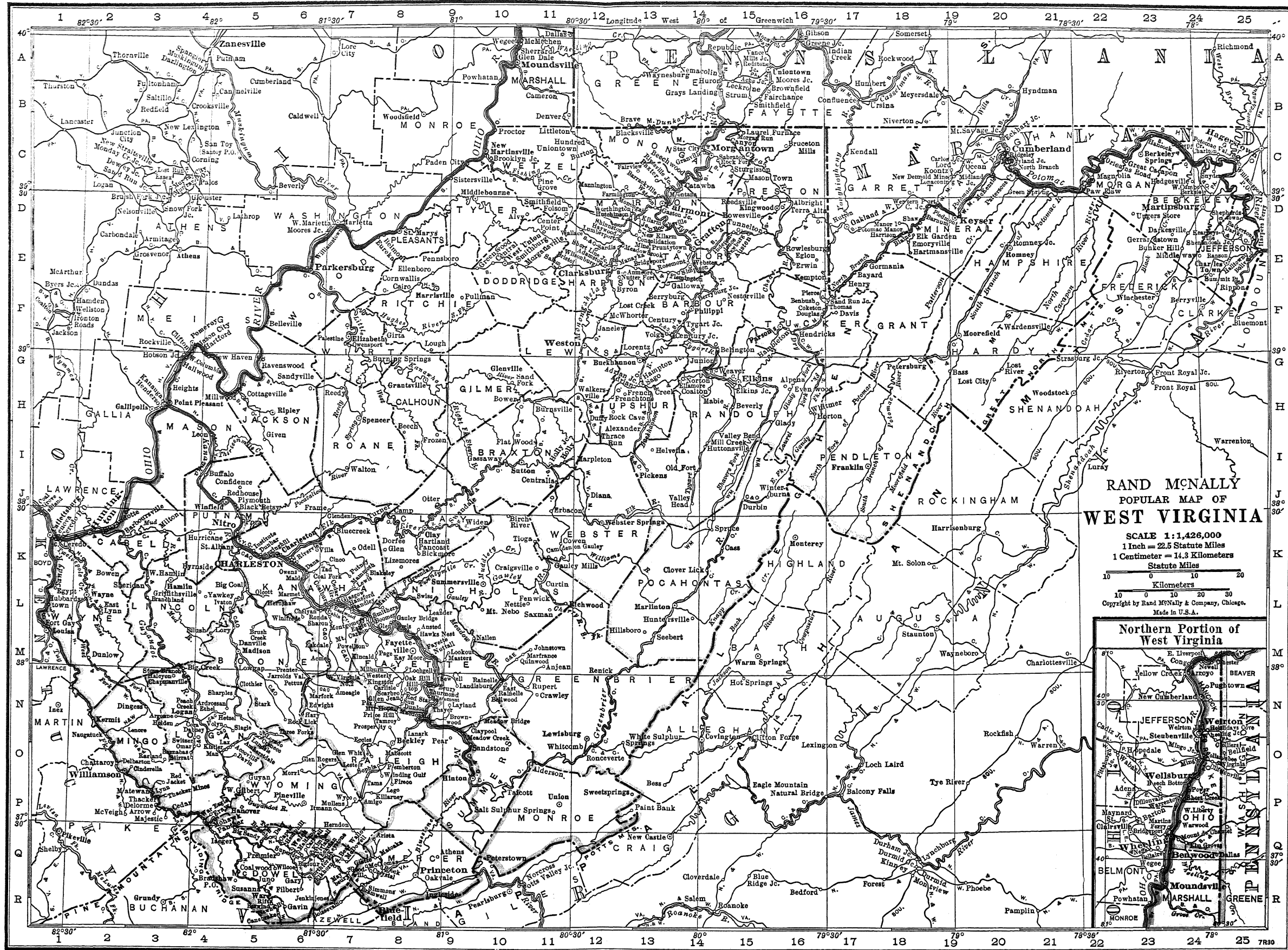
WEST VIRGINIA

Area, 24,170 sq. m.
Pop., 1,729,203

PRINCIPAL CITIES

Pop.—Thousands

- 2 Alderson, O 11
- 2 Barboursville, K 2
- 9 Beckley, O 8
- 2 Belington, G 14
- 4 Benwood, Q 24
- 19 Bluefield, R 8
- 2 Bramwell, R 7
- 2 Bridgeport, E 13
- 4 Buckhannon, G 13
- 2 Cameron, E 11
- 30 Charleston, K 6
- 2 Charles Town, E 25
- 4 Chester, M 24
- 29 Clarksburg, E 12
- 2 Davis, F 17
- 4 Dunbar, K 5
- 7 Elkins, G 13
- 23 Fairmont, D 13
- 5 Follansbee, O 24
- 2 Gassaway, I 10
- 2 Glen Dale, A 10
- 2 Grafton, E 14
- 7 Hinton, O 10
- 2 Holden, N 3
- 5 Holidays Cove, N 24
- 76 Huntington, K 2
- 4 Kenova, K 1
- 6 Keyser, D 19
- 2 Keystone, Q 7
- 2 Kingwood, D 16
- 4 Logan, N 4
- 2 McDowell, Q 7
- 4 McMechen, A 10
- 3 Mannington, D 12
- 2 Marlinton, L 14
- 1 Marmet, L 6
- 15 Martinsburg, D 24
- 1 Masters, M 9
- 2 Mayberry, Q 7
- 1 Milton, K 3
- 2 Monongah, D 13
- 3 Montgomery, L 7
- 16 Morgantown, C 14
- 14 Moundsville, A 10, R 23
- 2 Mount Hope, N 8
- 2 Mullens, P 7
- 2 New Cumberland, M 24
- 3 New Martinsville, C 10
- 5 Nitro, K 5
- 1 Norton, G 14
- 2 Oak Hill, N 8
- 2 Paden City, C 9
- 30 Parkersburg, E 6
- 2 Parsons, F 16
- 2 Petersboro, E 9
- 1 Phillips, F 14
- 2 Piedmont, D 19
- 2 Pierce, F 16
- 3 Point Pleasant, H 3
- 2 Power, P 24
- 7 Princeton, Q 8
- 1 Ranson, E 25
- 6 Richwood, L 11
- 2 Ridgeley, C 20
- 2 Rivesville, D 13
- 2 Roncove, O 12
- 2 Rowlesburg, E 16
- 2 Sabraton, C 14
- 2 St. Albans, K 5
- 2 St. Marys, E 11
- 2 Salem, E 11
- 3 Shinnston, E 11
- 3 Sistersville, D 9
- 6 S. Charleston, K 5
- 2 Spencer, F 17
- 2 Thomas, F 17
- 2 War Eagle, P 4
- 9 Weirton, N 24
- 5 Welch, G 12
- 6 Wellsburg, Q 24
- 2 Weston, G 24
- 2 Westover, C 14
- 32 Wheeling, Q 23
- 2 White Sulphur Springs, O 13
- 2 Widen, K 10
- 9 Williamson, O 2
- 2 Williamstown, D 7



RAND McNALLY POPULAR MAP OF WEST VIRGINIA

SCALE 1:1,426,000
1 inch = 22.5 Statute Miles
1 Centimeter = 14.3 Kilometers

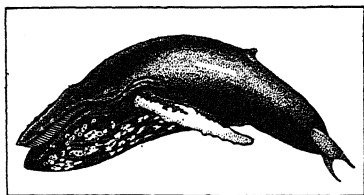
Statute Miles
Kilometers
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Northern Portion of West Virginia



out to found Salem. The older surviving houses are largely Georgian, and Sandsfoot Castle, built by Henry VIII to protect shipping, lies in ruins. To-day shipping is active still, as are the corollary industries of ship and boat building, sail and rope manufacture. Pop. 1921, 24,556; 1931, 21,982.

WHALE, a mammal of the marine order *Cetacea*. The order contains the largest animals known, past or present, with others of moderate size. Although undoubtedly descended from very remote land-walking ancestors, they have acquired a fish-like form suitable to locomotion in water, which they accomplish by movements of the horizontal tail-flukes, the small flippers on the breast (covering the arm-bones) acting more as balancers than as paddles. Cetaceans spend their lives wholly in the sea, where the young are born and nursed in mammalian fashion; and although they can dive to great depths, they must at intervals return to the surface for air to fill their lungs; as they do, in some species the pentup air in their lungs is forcibly expelled an instant before reaching the surface, often blowing the overlying water high into the air. This is called spouting, but no



HUMP-BACKED WHALE

water comes from inside the animal. The whale's skin is smooth, hairless, and usually blackish or black-and-white in color, variously marked; beneath the skin is a thick layer of fat or blubber, protecting the body from cold. The toothed whales feed principally on squids; the whalebone whales by skimming from the surface of the sea the plankton or numerous assemblage of small animals and plants always floating there.

Whales are found in all seas, but most numerous near the poles. Many wander widely, while other species are restricted in range. They are gregarious, and sometimes gather in large bands. All except the sperm whales are harmless and non-combative, but the latter fight with one another, and will attack boats and even ships when aroused. Their oil, baleen, and edible flesh are useful to mankind.

The whales are naturally separable into two divisions, the toothless (*Mystacoceti*) and the toothed species (*Odontoceti*). Those of the first division have no teeth, the mouth being filled with rows of fringed plates of a hornlike substance, baleen or whalebone, which hang from the palate and strain from the water their minute food. This group contains the largest whales, such as the rorquals (some of which approach 100 ft. in length), the southern right whale, the northern Greenland and the Pacific gray whale, and are called the whalebone whales.

The other division, the toothed whales, includes two groups: first, the two sperm whales; second, the beaked whales, the narwhals, killers, white whale (beluga), grampus, and many relatively small-sized dolphins and porpoises, some of which live in fresh waters. See WHALING; AMBERGRIS.

E. I.

WHALING. Two European peoples share the distinction of first daring to pursue whales in the water. By the 9th century, the Norwegians hunted them regularly, while the Basques traded in whalebone and oil from the 10th century until the 16th. In the 17th century, the Dutch whaling industry engaged 260 ships and 14,000 men. England next took the lead, to be surpassed by the United States in the 19th century. Centering at Nantucket and New Bedford, this American industry commanded 735 vessels and 70,000 people. Later, San Francisco became a strong rival port. In recent years, many nationalities have carried on systematic whaling. For the sperm and bowhead of the north, British, American, Greenland and Scandinavian hunters make regular trips. In northern waters, the Norwegians are the most numerous, with well organized sea and land equipment.

The famous American whalers of the 19th century were sailing vessels of 300 to 500 tons, or, later, screw steamers. Each carried 4 to 7 boats, and a crew of 35 to 60. The small boats put out after the whale and harpooning was dangerous and dramatic, the animal often dragging and sometimes capsizing the following boat. Once dead, the whale was lashed to the vessel and the process of "flensing" began. Blubber was removed in huge pieces, and the fat tried out before boiling for oil. A ton yielded about 200 gals. of oil, and one whale might easily furnish blubber and bone worth \$4,000. After stripping, the carcass was set adrift.

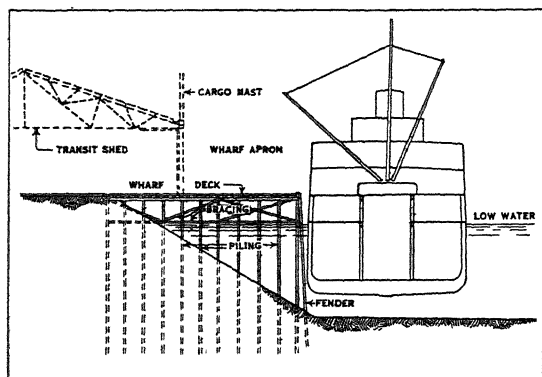
With the invention, in 1866, of the explosive harpoon by Sven Foyn, a Norwegian, began the modern whaling era. This harpoon, discharged from a cannon, has an explosive cap which on striking drives 12-inch barbs deep into the flesh. The harpoonist is a skilled marksman, highly paid. With this modern mechanism, fishers can take the fierce rorqual, largest of the whales, and the once-dangerous humpback.

Modern whalers are speedy, easily handled vessels with many mechanical facilities. In the north, the captive whale is usually towed to a shore station for final handling. The latest development, however, has been the Norwegians' successful Antarctic ventures with a new type of vessel which is in truth a "floating factory." These ships run up to 30,000 tons, are built to stand pressure of the ice packs, and are equipped with machinery to utilize every bit of a carcass. All the handling is done with winches and power. Through a huge opening in the stern, the whales are dragged up an incline to the upper deck. The blubber is stripped and cut by chopping machines and the oil cooked out in huge vats by high pressure steam. Every part of the body containing oil is tried

out—the resultant different grades being kept separate. The remaining flesh is ground into meat scrap for poultry feed, as are the bones. Their huge tanks give these ships an enormous carrying capacity; one recently brought into New York a cargo valued at over \$2,000,000. The oil coming to the United States is largely sold to soap-making companies.

Each of these factory ships is attended by small, fast hunting ships. Each carried five or six men, has a wireless and a high power harpoon gun. When the whale is killed, the compressed air-inflated body is left floating to be picked up later. When several have been killed, they are towed to the mother ship or she is summoned by wireless.

At present, at least six of these huge factory ships are working the Antarctic waters, and each kills several thousand whales a year. This enormous increase of pelagic whaling now actively threatens the extinction of all hunted types of whale. Different nations regulate fishing off their own coasts, and an international group has met to discuss uniform regulations.



CROSS SECTION OF WHARF, PILE TYPE

Beside the highly organized whaling industries, there are fair-sized local fisheries which take smaller species for blubber, leather and other products. The black pilot whale and grampus are taken by Faroe Islanders and Norwegians; the white whale is hunted off Alaska; the ivory-tusked narwhal is prized by Greenlanders, and dolphin and porpoises are taken off Africa and South America.

In 1930, according to U.S. Bureau of Fisheries statistics, Pacific Coast whaling operations, Canadian and American included, produced 2,059,050 gals. of whale and sperm oil, while the number of gallons from 1912 to 1930 inclusive, totaled 26,214,853, from a catch of 14,816 whales. In addition, baleen, from which commercial whalebone is made, guano, bone meal and other products have reached a high valuation.

A. R. F.

WHARTON, EDITH (1862-), American author, née Edith Newbold Jones, was born in New York City in 1862. She was privately educated and in 1885 married Edward Wharton, a Boston banker. She lived much of the time abroad, chiefly in France and Italy. Mrs. Wharton is best known for her novels

and short stories. *The House of Mirth*, 1905, established her reputation. Among her outstanding works are *Ethan Frome*, *The Age of Innocence* and four stories portraying the life of old New York through 1840-70, *False Dawn*, *The Old Maid*, *The Spark*, *New Year's Day*. Her later works include *Hudson River Bracketed*, 1929, and *The Gods Arrive*, 1932.

WHARTON SCHOOL OF FINANCE AND ECONOMY. See PENNSYLVANIA, UNIVERSITY OF.

WHARVES, the general term for landing places for vessels and cargoes, may be laid out in various ways along the shore, offshore and parallel, or projecting. See QUAYS; PIERS. Constructed in various forms and of various materials, the most familiar is a timber platform supported on timber piles. Floating wharves—"wharf boats" or "floating landing stages"—are often used when the range in water level is great.

BIBLIOGRAPHY.—C. Green, *Wharves and Piers*, 1917.

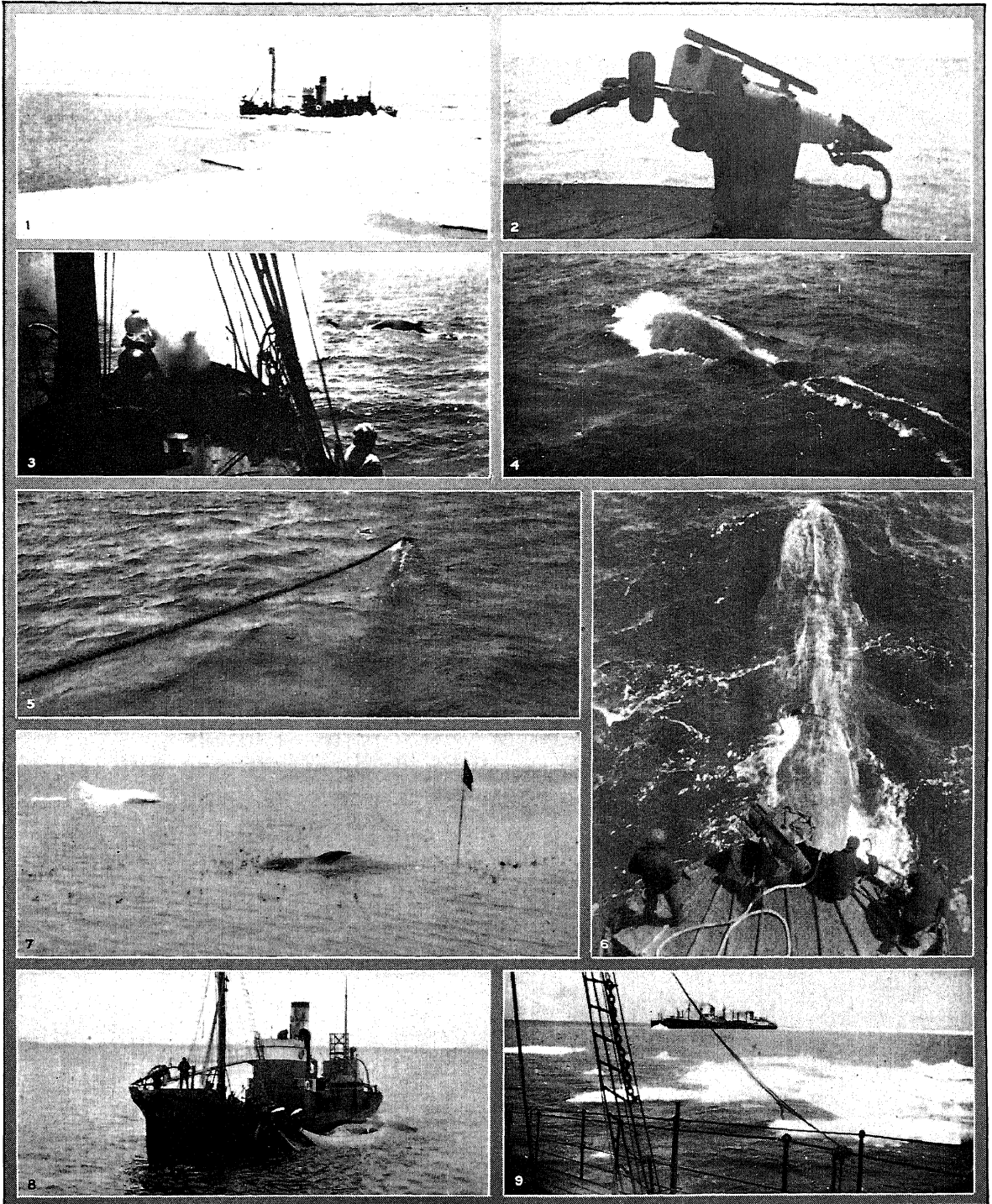
WHEAT, the most widely known and important of all cereals grown for human and animal food. Among peoples of the Aryan group it is the leading flour and breakfast food, though in the latter rôle oats and corn are close rivals. The grain, ground or whole, and the by-products of milling, as bran, and middlings, are highly valued as stock foods. Besides the numerous forms or races of common wheat (*Triticum aestivum*), there are several varieties the seed of which is used for human food, as emmer, durum, spelt, poulard and the club wheats. These are grown mostly in the Old World and are of minor importance in America.

History. The parent wild species and original home of the wheat plant is unknown but all available evidence seems to point to western Asia. At the time of the erection of the most ancient tombs in which the grain has been found it was already domesticated, as proved by comparison with samples of varieties still in cultivation. Records also show that the ancient Egyptians and Greeks attributed its origin to their respective deities. In China, where it has been grown for more than 4,500 years, it is considered a direct gift from heaven and is annually sown in certain Chinese religious ceremonies. Wheat grains have been found among the relics of the Lake Dwellers of Switzerland. In Palestine wheat was the "corn" of Biblical records, and it has long been cultivated in India.

Characteristics. From the cultural standpoint the wheat plant is both adaptable and hardy, having ability to endure climatic conditions from central Florida to Alaska and from southern Brazil to middle Argentina. However, the plant has been so modified by selection, breeding and cultivation that its characters are largely artificial. Should it be allowed to shift for itself it would disappear within a few years because it has lost the power to adapt itself to uncultivated areas and to compete unaided by man with other plants.

Wheat races, commonly styled varieties, of which hundreds have been developed are variously classified, as bearded and beardless (or bald), red and white, hard and soft, spring and fall. Spring wheat is sown

WHALING



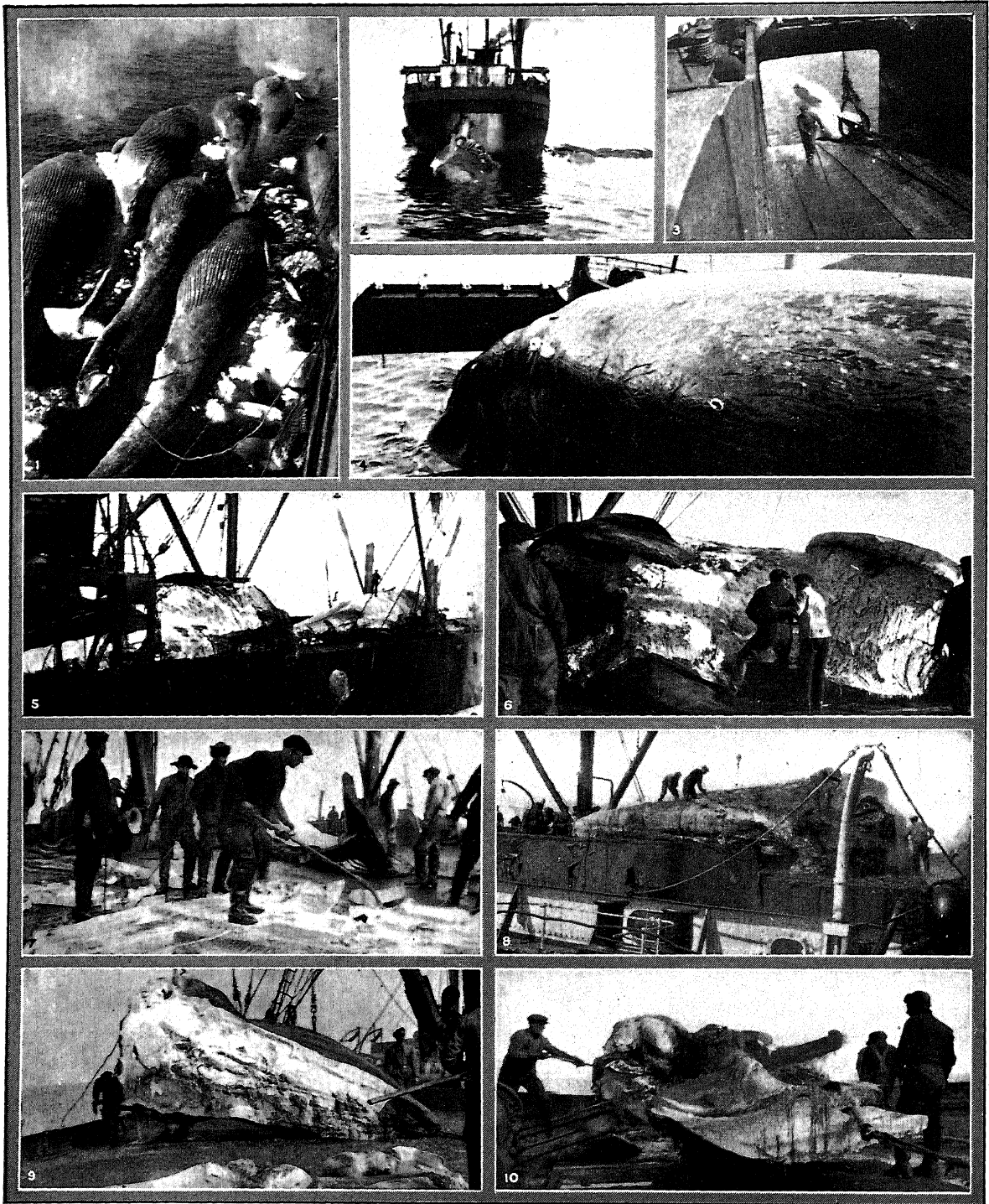
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TRACKING THE WHALE BY PRESENT-DAY METHODS

1. Modern whaler hunting in pack ice. 2. Gun loaded with harpoon grenade which is shot at the whale; a heavy winch is the fisherman's reel. 3. Harpoon in flight after a shot. 4. A hit; the whale is fast to the harpoon. 5. Playing the whale. The "blow" of the animal is visible. 6. Inserting the air pump in the capture. To prevent the dead whale

sinking he is pumped up from a compressed air tank. 7. "Flagged" whale. 8. Bringing the day's catch to the mother ship; there are two blue whales on each side, making the catcher ride upright. 9. A mother ship in the ice, working up whales and simultaneously loading fuel oil from, and discharging whale oil into, a modern motor-tanker.

WHALING



COURTESY CHRISTIAN SALVESEN & CO., LEITH, SCOTLAND

ABOARD A MODERN WHALER

1. Blue whales alongside the mother ship. 2, 3, 4. Blue whales going up the stern-slipway. 5. Drawing a flensed carcass to the working deck where it is dismembered and all the meat and bones filled into pressure-boilers. 6. Flensing. The last strip of blubber has been peeled off by a wire on a heavy steam winch and the head and jaws re-

moved and drawn to the working deck. 7. Cutting strips of blubber into suitable sizes for the blubber boiler. 8. Dismembering the carcass. 9. Flensed head being brought to the bone-saw. Sawed portions of the jawbone in the fore ground. 10. Steam bone-saw at work on the head. The "whalebone" finners have been removed from the palate.

when winter ends and is harvested in 12 to 20 weeks, depending upon the variety and the season; fall wheat is sown in early autumn and harvested four to six or more weeks earlier than the spring sown sorts. The quality of the grain is largely dependent upon climate, season, soil and varietal differences.

Growth. When wheat seed germinates it develops a whorl of three temporary roots and a stalk from the lower joints of which appear the permanent roots. These push outward and downward to prop as well as feed the plant. Plants of winter wheat produce crowns or rosettes of leaves which protect the other parts during the dormant season. When activity is resumed several to many, sometimes 100, usually hollow stalks develop from a single seed. This habit of "tillering" or "stooling" varies with the variety, the season and the soil. Upon it largely depends the stand of the crop. Near the ground the stalks have joints close together, higher up they are far apart. The full height of the stalks ranges from 2 to 6 ft. Each stalk normally terminates in an erect spike or head, 2 to 6 or 8 in. long, raised well above the foliage. The stalks, upper leaves and heads gradually turn golden yellow as the seed matures.

On light gravelly or sandy, acid, wet, mucky and over-rich soils, wheat makes poor growth, lodges, or falls down badly or fails altogether. For its best development it requires a deep, moderately fertile, well-drained, properly prepared, permeable, neutral or slightly alkaline soil, preferably with a fair proportion of clay and some lime in its composition. It also grows well on alluvial soils and on most of those classed as heavy but not sticky.

Cultivation. Preparation of the land consists in manuring, plowing, fertilizing, harrowing, rolling and seeding in the order named. Though broadcasting and harrowing in the seed is still practiced to some extent, the usual method is to drill the grain, because it distributes the seed evenly and at uniform depth, thus favoring the stand. As wheat makes its important growth during cool weather it should always be sown as early as favorable conditions arrive, in moist but not wet soil. Wheat is usually harvested in the dough stage, before it gets fully ripe, to prevent shattering or loss of kernels from the heads. Sickles, scythes and cradles have been largely replaced by machines. The reaper, drawn across the field, cuts and holds the stalks until enough for a sheaf have collected, then drops them for binding and shocking by hand; the self-binder, also drawn, does the binding with twine; the header, pushed forward, takes a swath 10 or 12 ft. wide but cuts and binds the stalks close below the heads; the machine called the combine threshes and delivers the grain in tied sacks as it is pushed forward.

Crop Rotation. When grown continuously on the same area it steadily decreases in yield of both grain and straw, as evidenced in the prairie states where it begins to fail within a few years of breaking the virgin soil. For best results, therefore, as well as for economy of growing and maintenance of fertility,

wheat should always be grown in rotation with other crops.

Rotations vary with the region. Among dairy farmers in New England and the North Atlantic states a favorite sequence is silage corn, wheat and clover. In sections where oats are wanted the order is usually corn, oats, wheat, clover. Often potatoes are substituted for corn. In the corn belt the usual practice is corn two years, oats, fall wheat, clover; but where spring wheat is grown this crop alternates with corn alone, a plan by no means ideal but better than continuous cropping with either crop exclusively. In semi-arid districts wheat is often rotated with summer fallow every two to four years. This faulty method is being replaced by rotation with perennial grass or legumes or both. On irrigated land wheat often follows potatoes or sugar beets which come after three or more years of alfalfa. In Colorado and other sections where peas are grown for sheep, potatoes and wheat follow in this order. M. G. K.

Food Value. As in the case of other cereals, wheat proteins possess less food value than equal quantities of animal proteins, such as those found in meat, eggs and milk. This is due to the fact that the vegetable proteins contain considerably smaller amounts of certain amino acids, especially lysin and tryptophane, necessary for body maintenance and growth. Whole wheat grains have some vitamin A in the germ and more vitamin B; patent flour, however, contains practically no vitamin A, but little vitamin B, and a very low mineral content. The constituents of wheat flour are protein from about 7% to 12%, starch about 75%, moisture 13.5% more or less, fat 1% to 2%, and a small remainder of mineral matter and fiber. The energy value of wheat flour is about 1,600 calories per pound. Theoretically, because of its higher protein vitamin and mineral-salt content, whole wheat flour might seem preferable to patent flour. Serious objections, however, prevent the extensive manufacture of whole wheat flour; it spoils easily, is too perishable for international trade, and would have to be ground in small local mills. Moreover, the public in general strongly prefers white flour. C. L. A.

Production and Trade. The world production of wheat has been on the increase for several decades, with the exception of bad years, and it was augmented from 3,150,000,000 bu. in the 1924-25 season to 3,973,000,000 bu. in the 1928-29 season. In the meantime the carry-over was increasing so that the available supply for the 1928-29 season was about 900 million bushels greater than it was four years previous. The development of better varieties of wheat together with the tractor and harvester which facilitate cultivating and harvesting are largely responsible for the increase, while a decrease in per capita consumption has largely effected the increase in surplus. The increase in production and decline in per capita consumption, together with the general depression (1930-31) brought the price to the lowest price levels since the World War.

The countries contributing the most to the world's

supply of wheat are the United States, Russia, Canada, India, France, Italy and Argentina. In 1930, the United States produced 850,965,000 bu. with a farm value of \$517,407,000 from an area of land totaling 59,153,000 acres, an average of 14.4 bu. per acre. In the United States wheat is grown as a market crop most extensively in Kansas, North Dakota, Nebraska, Montana, Oklahoma, Washington, Illinois, Minnesota, Indiana and Ohio, with Kansas producing far more than any other state.

WHEAT PRODUCTION, U.S.

7-Year Average, 1924-30

Division	Acreage (1,000 Ac.)	Production (1,000 Btt.)	% of Tot. Prod.
UNITED STATES	56,990	832,281	100.0
LEADING STATES:			
Kansas	10,325	139,074	16.7
North Dakota	9,764	115,076	13.8
Nebraska	3,353	58,047	7.0
Montana	3,750	52,022	6.3
Oklahoma	3,887	47,286	5.7
Washington	2,205	42,798	5.1
Illinois	2,251	36,025	4.3

Immediately preceding the World War, Russia was exporting 57% more wheat than the United States. During the war this production dropped considerably, but showed signs of revival in 1926, and in 1930 the estimated total production was 1,157 million bushels. The consumption in Russia, however, has increased materially so that her exports are not as large as formerly. Ordinarily the largest exporters of wheat are Canada, United States, Argentina and Australia, while the largest importers are the United Kingdom, Germany, Italy and France. The United States also imports considerable quantities to be used in milling products manufactured for exportation, and most of its imports, about 98%, come from Canada. Of the wheat and wheat products shipped from the United States about 30% usually goes to Canada, 25% to the United Kingdom and large amounts to Japan, Belgium, Netherlands and other countries of Europe. In the world's market, Europe, outside of Russia, is the largest consumer.

WHEAT BELT, the name applied to that section of the United States which produces more than two-thirds of the nation's wheat crop. The name, in reality, denotes two districts or belts, the north and the south which are divided roughly by the CORN BELT. The northern belt raises spring wheat, i.e., hard red spring and durum wheat, and comprises North and South Dakota, Minnesota and eastern Montana. The southern belt raises winter wheat, soft red winter and hard red winter, and includes Illinois, Indiana, Ohio, southern Nebraska, central Kansas, western Oklahoma, northern Texas and part of southern Pennsylvania. White wheats of both the spring and winter varieties are grown extensively in the Pacific Northwest.

WHEATEAR, a small song bird (*Saxicola oenanthe*) of the thrush family allied to the stonechat. Frequenting barren, rocky places, it ranges

widely in Europe and northern Asia and occurs also in Iceland, Greenland and Alaska, wintering in Asia, northern Africa and northern Quebec. It is about 6 in. long, with gray, black and white plumage. The wheatear utters a short sweet song, feeds on insects, and nests usually among rocks, laying four to seven bluish eggs. In the autumn when it is fat, the wheatear is netted in great numbers for food.

WHEATLEY, PHILLIS (c. 1753-84), American Negro poetess, was born in Africa, about 1753. She was brought to America in 1761 by a slave trader and sold to John Wheatley of Boston. Because she evinced unusual intellectual gifts, she was educated by the Wheatleys, and began at an early age to write poetry. Her poems were published and praised at the time as phenomenal. Phillis Wheatley died in Boston, Mass., Dec. 5, 1784.

WHEATON, a residential city and the county seat of Du Page Co., Ill., 25 mi. west of Chicago. It is served by the Chicago and North Western and the Chicago, Aurora and Elgin (electric) railroads. It is the seat of Wheaton College, 1860, and is a shipping center for grain, livestock and agricultural products. Wheaton was founded in 1837, and incorporated in 1859. It has the commission form of government. Pop. 1920, 4,137; 1930, 7,258.

WHEATON COLLEGE, at Norton, Mass., a non-sectarian privately controlled college for women, founded in 1834 as Wheaton Seminary. The institution was chartered as a college in 1912, at which time the present title was assumed. It had an endowment fund in 1931 amounting to \$1,081,000. The library contained 26,724 volumes. In 1931-32 there were 453 students and a faculty of 64, headed by Pres. JOHN EDGAR PARK.

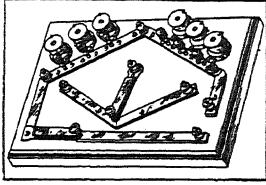
WHEATSTONE, SIR CHARLES (1802-75), British physicist, was born near Gloucester, in Feb. 1802. Largely self-taught, he spent the earlier years of his life as a maker of musical instruments in London, at the same time conducting experiments on sound which brought him to the attention of Michael Faraday, who obtained for him a professorship of experimental philosophy at King's College, London. He became widely known as an inventor and designer of delicate instruments. Together with W. F. Cooke, he took out in 1837 the first patent for an electromagnetic telegraph. He continued to play a prominent part in the development of telegraphy, and in 1868 produced his automatic telegraph. He was an authority on cipher. Wheatstone was knighted in 1868. The WHEATSTONE BRIDGE is named after him. He died at Paris, Oct. 19, 1875.

BIBLIOGRAPHY.—*Scientific Papers of Sir Charles Wheatstone*, published by the Physical Society of London in 1879.

WHEATSTONE BRIDGE, a circuit arrangement used in the measurement of electrical RESISTANCE. It consists, first, of a pair of resistors, known as the ratio arms, connected in series and across a source of electromotive force. The unknown resistance is connected in series with a calibrated, variable resistor and this series combination is also connected across the same

source of electromotive force. Between the junction points of each of these pairs of resistances a GALVANOMETER, protected by a suitable shunt, is connected.

The process of measuring an unknown resistance consists of adjusting the ratio arms and the variable balancing resistor until the galvanometer deflection is zero. Under these conditions the unknown resistance is equal to the value of the variable resistance multiplied by the ratio of the ohms in the arm opposite the unknown resistance to the ohms in the other arm. Wheatstone



COURTESY CHICAGO APPARATUS CO.
DEMONSTRATION MODEL
WHEATSTONE BRIDGE

bridge boxes are available which contain these units in a form convenient for manipulation. W. H. T.

WHEEL, a circular member used for transmitting or modifying motion. It comprises a solid disc or a circular frame which rotates about its axis. The point of the axis is the center of a hole which fits over an AXLE, the part of the wheel surrounding this hole being termed the *hub*. In the frame wheel, the peripheral rim or "feloe" is connected to the hub by radial spokes. The wheels on a vehicle are used for reducing friction.

WHEELER, BENJAMIN IDE (1854-1927), American educator, was born in Randolph, Mass., July 15, 1854. After graduating in 1875 at Brown University he taught classics in the Providence high school and at Broan for six years, and from 1881-85 he traveled in Europe and studied at Leipzig, Heidelberg, Jena and Berlin. In 1886 Wheeler became professor of comparative philology at Cornell University and in 1888 professor of Greek. He was elected in 1899 president of the University of California, where he remained until 1919. He died in Vienna, Austria, May 3, 1927. His many works on philology and education include *Introduction to the Study of the History of Languages*, *Principles of Language Growth and Life of Alexander the Great*.

WHEELER, JOSEPH (1836-1906), American soldier, was born at Augusta, Ga., on Sept. 10, 1836. He was graduated from West Point in 1859, and was assigned to the United States cavalry. At the outbreak of the Civil War he resigned from the Federal army to become a colonel in the Confederate forces in 1861, in 1862 a brigadier-general, in 1863 a major-general, and in the later stages of the war a lieutenant-general. His command was prominent at Chickamauga, Chattanooga and Atlanta, and in impeding Sherman on his "March to the Sea." His cavalry unit surrendered as part of Gen. Joseph Johnston's army in 1861. In 1880-99 he was a Democratic member of Congress from Georgia. As a major-general in the Spanish-American War he commanded a cavalry unit, saw active service at San Juan and Guasimas, and became a military hero in the United States. After further service in the Philippines, he was made a

brigadier-general of regulars. He died at Brooklyn, N.Y., on Jan. 25, 1906.

WHEELER, WILLIAM ALMON (1819-87), statesman and Vice-President of the United States, was born at Malone, N.Y., on June 30, 1819. He studied for two years at the University of Vermont, and was admitted to the bar in 1845. Appointed in 1847, he was United States district attorney of Franklin Co. until 1849. He later became a banker and president of the Northern New York railroad company. At first a Whig he joined the Republican party in 1856. He was in the state assembly, 1849-50, and was a member and president *pro tempore* of the state senate, 1858-59. In 1861-63 and 1869-77 he was a member of the national House of Representatives. He was the author of the "Wheeler compromise" by which the political conflict in Louisiana was settled in 1875. In 1876 he was elected Vice-President on the ticket with President Hayes. He died at Malone on June 4, 1887.

WHEELER NATIONAL MONUMENT, a tract of 300 acres in Mineral Co., southwestern Colorado, set aside as a government reservation, Dec. 7, 1908 under the jurisdiction of the Department of Agriculture. The region contains examples of erratic erosion of volcanic rocks of unusual scientific interest. Grotesque pinnacles and fantastically carved-out gorges characterize the section. The monument is accessible from Wagon Wheel Gap or Creede, both on the Denver and Rio Grande Western Railroad.

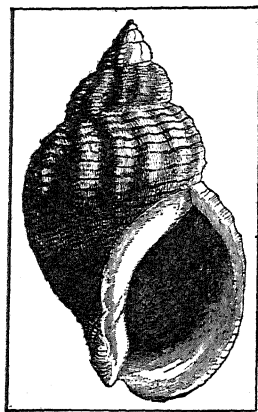
WHEELING, a city of the northern panhandle of West Virginia and county seat of Ohio Co., on the Ohio River, 47 mi. directly southwest of Pittsburgh, Pa. The Baltimore and Ohio, the Pennsylvania, and the Wheeling and Lake Erie are the main railroad lines serving the city; river boats and bridges are among other transportation facilities. Because of its strategic location, Wheeling early became an important frontier post for westbound pioneers. It was chosen in 1818 as the western terminus of the National road, and a regular stage-coach service was operated between Baltimore, Washington and Wheeling. Later, 1852, it was reached by the Baltimore and Ohio Railroad. From a shipping point it developed into a producing center of the regional abundant resources of coal and natural gas. In 1929 the manufactured output was valued approximately at \$53,000,000, and included extensive iron and steel production and the manufacture of glassware, textiles and tobacco. The retail trade during 1929 amounted to \$42,068,220. Wheeling's educational institutions include Linsly Military Institute (1848). Many places of historic interest are within the city limits, including the site of Ft. Henry (a blockhouse erected in 1774 as Ft. Fincastle and later renamed to honor Patrick Henry), which withstood several Indian attacks. Here, in 1769, the first permanent settlement on the Ohio River was established by Col. Ebenezer Zane. The town was plotted in 1793, incorporated 1806 and chartered in 1836. It was the meeting-place, in 1861-62, of the

convention which framed West Virginia's constitution, and it became the state capital, 1863-70, and again, 1875-85. Pop. 1920, 56,208; 1930, 61,659.

WHEEL-SCRAPER. See SCRAPERS.

WHEELWRIGHT, WILLIAM (1798-1873), an American capitalist, born at Newburyport, Mass., whose activities in South America made valuable contributions to the development of transportation and navigation. He established the Pacific Steam Navigation Company, which in 1840 began operating a line of steam vessels on the west coast from Valparaiso, Chile, to Panama. In addition to this he built a railroad from Caldera to Copiapo, Chile (1852), and cooperated with another American, Henry Meiggs, in building a line from Santiago to Valparaiso (1863). He next organized the Central Argentine Railroad Company and completed a road from Rosario to Cordoba (1870); and from Buenos Aires to the seaport of Ensenada (1872). Wherever Wheelwright went he introduced gas and water works into the towns. He is also credited with having erected the first telegraph in South America. Wheelwright died in 1873.

WHELK, the common name for many species of sea snails, or marine gastropods, of the sub-order *Rachiglossa*, which have thick spiral shells. All are active carnivores, and often eat other mollusks, crustaceans, or any available animal food, living on carrion. Their eggs are protected by tough capsules, and are often found in large clusters which may be several inches across.



COMMON WHELK

The common whelk (*Buccinum undatum*) is found on the American and European shores of the North Atlantic, and on the coast of Greenland. It lives in both shallow and deep water. In America it does not exceed a length of 2½ in., but in England, where it is known as the great whelk, or roaring buckie, the shell may grow to be 6 in. long. This species is eaten in Europe. Other familiar whelks are the dog whelks (*Purpura*) and the rock whelks (*Murex*). See also ROCK SHELL.

WHIG PARTY, a major political party in the United States, 1834-54, opposed to the DEMOCRATIC PARTY. It developed during President Jackson's administration by the aggrandizement of opposition groups: Anti-Jackson Men, Antimasons, and those favoring a protective tariff, a national bank and a system of internal improvements. The name Whig, apt because a leading principle of the Whigs in English politics was opposition to executive usurpation, was first used by James Watson Webb, editor of the *New York Courier and Enquirer*. In 1835 several Whig state conventions made nominations for the

presidency, namely for DANIEL WEBSTER, WILLIAM HENRY HARRISON and HUGH L. WHITE, all of whom received electoral votes, when Van Buren was elected by the Democrats in 1836. In 1840 the party's first national convention nominated for president and vice-president Harrison and JOHN TYLER. Presenting no platform, but campaigning enthusiastically, the party elected its nominees, only to be thwarted by the death of Harrison and the accession of Tyler, who alienated his support by vetoing certain Whig measures, notably the bills for the incorporation of a national bank. In 1844 the party nominated HENRY CLAY, and adopted a platform calling for "a reform of executive usurpations," a protective tariff, a revised financial system, and the distribution of the proceeds from the sales of public lands to the states. Clay's temporizing over the question of the annexation of Texas cost him the northern votes necessary for election; this question was the first of the sectional differences which split the Whig party. In 1848 the Whig candidate, ZACHARY TAYLOR, was elected, although again the party adopted no platform. The support given the COMPROMISE OF 1850 by the Whig party, in an attempt to retain both its northern and southern elements, was the greatest contributing factor in the defeat of its candidate in 1852, WINFIELD SCOTT. The KANSAS-NEBRASKA BILL, 1854, hopelessly disrupted the Whig party, its northern element deserting it in large numbers to form the REPUBLICAN PARTY. In 1856 the last Whig convention endorsed the candidate of the KNOW-NOTHING PARTY.

WHIGS and TORIES, the names used to designate the two chief opposing political parties in England between the dates 1680 and 1832. The name Whig was the shortened form of Whigamore, a name given to the peasants in western Scotland because of their call of "Whiggam!" to their horses. In connection with the members of the political group, Whig implied a Presbyterian rebel. The name Tory was a term used in Ireland in reference to an outlaw, so that its implication in regard to political opponents was a Popish thief. In 1680 the faction led by the Earl of Shaftesbury petitioned repeatedly for CHARLES II to call a meeting of Parliament; the members of the party were promptly dubbed Petitioners and later Whigs by the courtiers. Those opposed to such a method of obtaining a Parliamentary session were called Abhorrrers and later Tories. The stronghold of the Whigs was the Commons, while that of the Tories was the Lords; the Whigs allied themselves with the powerful nobles, the Tories with the Crown. From 1681 to 1714 the Tories were in power. But in the latter year, when the Tories could not decide on Queen Anne's successor, the Whigs came into power under the Hanoverians and kept it until 1754. In that year the Tories came back into favor, and subsequently carried on the SEVEN YEARS' WAR and the REVOLUTIONARY WAR. Those who favored the Crown in the Colonies were then called Tories, and those who favored the rebels, Whigs.

After the turn of the century the Whigs stood for

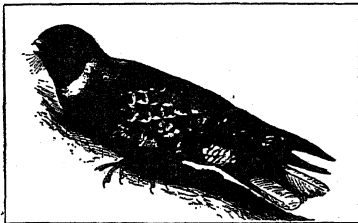
Parliamentary reform, while the Tories were generally thought of as resisting all change. In 1820-30 the Tories split, dividing into the followers of Wellington and Peel and the Canningites. The latter united later with the Conservative Whigs. Gradually the Tories developed into Conservatives under DISRAELI and the Whigs into Liberals under GLADSTONE, and the former party names passed from general use. *See also* ENGLAND, HISTORY OF.

WHILKUT, a North American tribe belonging to the coast division of the Athapascan linguistic stock and occupying the upper valley of Redwood Creek in northern California. Linguistically they were closely related to the Hupa but they differ in religion and were not politically affiliated with them. Though at one time segregated on the Hupa Reservation, they returned to their ancient habitat and in 1910 the Government census recorded their number at 50 full bloods and several mixed-bloods.

WHIN, a name given in Great Britain to the *FURZE*, an exceedingly thorny shrub of the pea family common on gravelly heaths, called also gorse.

WHIP, a party official in the British House of Commons. His primary function is to insure a full attendance of the members of the party when an important division is impending and the fate of the government may be involved. He must also keep the leader informed as to the temper of the rank and file and exert himself to maintain harmony. The government whips hold sinecure offices, the chief whip being parliamentary secretary of the treasury and his three assistants junior lords. In the United States, less significance attaches to the party whips in Congress where party lines are seldom closely drawn and where votes do not affect the tenure of the executive.

WHIPPOORWILL, a small bird (*Antrostomus vociferus*) of the goatsucker family *Caprimulgidae*, named in imitation of its peculiar nocturnal call. A



WHIPPOORWILL

familiar bird in eastern North America, it breeds locally from New Brunswick and Manitoba to the Gulf States, wintering southward to the northern tropics. It is about 10 in. long, with soft plumage mottled with brownish, grayish and black above, and buffish barred with black below, with a narrow white band across its breast. Usually frequenting thickets or brush-covered hillsides, it remains concealed and quiet during the day; at night it seeks its food of insects which, while flying close to the ground, it catches in its large, bristle-armed mouth. On the bare ground

or on leaves in woods or thickets, it lays two dull white, spotted eggs. *See also* CHUCK-WILL'S WIDOW; POOR-WILL.

WHIRLIGIG BEETLE, an aquatic, carnivorous beetle of the coleopterous family *Gyrinidae*, of which nearly 40 of about 350 known species are found in the United States. It darts about on the surface of the water in great gyrating companies. It is propelled by the two hind pairs of legs.

WHISKY or WHISKEY, a distilled alcoholic liquor made from grain. Malt whisky is obtained from the fermented mash of malted barley, rye whisky from a mash made up of malted rye, and corn whisky, often called Bourbon after the county in Kentucky, from corn. Wheat is the chief constituent of wheat whisky. Scotch whisky is distilled from malt, and the Irish product from either potatoes or malt. Most American brands are made from corn or malted rye. In order that chemical changes can take place and give whisky its finest flavor, the distilled liquor must be thoroughly aged in wooden casks. *See also* SPIRITS.

WHISKY INSURRECTION, the violent resistance in western Pennsylvania, 1791-94, to the enforcement of the Federal excise upon domestic distilled liquor and stills. Practically all non-local commerce of the western counties was in whisky, necessarily, since each horse of a pack train could carry only four bushels of wheat or two eight-gallon kegs of whisky. The wheat was of insignificant worth in Baltimore and the towns of eastern Pennsylvania, while the whisky was worth fifty cents to one dollar a gallon. The Federal act of March 1791, sponsored by ALEXANDER HAMILTON, imposed a high levy, ten to twenty-five cents per gallon upon whisky and a correlative tax upon stills. It provided for the creation of inspection districts, with a host of petty officers. The assessment, for purposes unpopular in the West, such as redemption of Continental securities, mostly in the hands of speculators, toward the interest upon the public debt, followed upon a long series of grievances: laxity of the Government in driving back the Indians; failure to force the British to evacuate the northwestern posts; failure to secure the free navigation of the Mississippi; and grievances inherent in the people's situation as farmers and debtors. Inspectors appointed under the excise act were harassed; barns and other property of those who acquiesced in the enforcement were destroyed. Indignation meetings forwarded futile resolutions to Washington. Gen. John Neville, chief inspector of the western district of Pennsylvania, was fired upon and his home burned. David Bradford, leader of the most lawless group of the opposition, robbed the mails, removing the letters from the Pittsburgh packet denouncing the late outrages, and called a meeting at Braddock's Field, on the Monongahela near Pittsburgh, for Aug. 1, 1794, to march upon the authors of the "treasonable" correspondence. About 6,000 men assembled; moderate counsels, offered by Hugh Henry Brackenridge, Albert Gallatin and others, prevailed, and the gathering contented itself with march-

ing through Pittsburgh, "taking a little whisky with the inhabitants of the town."

Federal and state commissioners at this meeting offered general amnesty upon submission to the excise, but found the assembly too little organized for formal consideration of the terms. The commissioners returned to Philadelphia, and forwarded a report to Washington that the western counties were in a state of insurrection. On Sept. 25 the President issued a proclamation calling for submission, and announcing the dispatching of a force of 15,000 militia. Meanwhile, however, a second convention of the westerners, at Parkinson's Ferry, had pledged obedience and submission; and the insurrection was actually moribund before the militia arrived. The inhabitants of the western counties were required to subscribe to an oath of submission and peaceful behavior. Some 300 were arrested in a single night, Nov. 13, 1794, most of whom were discharged after examination a few days later. Two convicted of treason were pardoned by the President. The Whisky Insurrection was the first instance in which the Federal Government's most extreme powers of coercion were invoked.

BIBLIOGRAPHY.—H. M. Brackenridge, *History of the Western Insurrection in Western Pennsylvania, 1859*; William Findley, *History of the Insurrection in the Four Western Counties of Pennsylvania, 1796*.



FROM JEPSON. MAN. FL. PLANTS CALIF., COPYRIGHT

WHISPERING BELLS
Leaf and flowering branchlet

WHISKY RING, a coterie of whisky manufacturers and officials in the Federal internal revenue service, formed during the administration of President Grant, for the purpose of defrauding the Government. The headquarters of the ring were in St. Louis, and distillers in Milwaukee, Peoria, Chicago, Cincinnati and New Orleans were involved. The United States was defrauded of at least \$4,000,000 before the investigation conducted by Secretary of the Treasury Benjamin H. Bristow exposed the coterie. On May 10, 1875, 16 distilleries of an aggregate value of \$3,500,000 were seized and 239 persons indicted, including Gen. Orville E. Babcock, President Grant's

private secretary, and the chief clerk in the Treasury Department. It developed that the coterie had been organized by John McDonald, a politician of ill repute in St. Louis but a personal friend of Grant's, who had been appointed to a responsible Federal position in 1870. Grant secured modifications of the policy of the prosecution which minimized the sentences given the defendants; most were pardoned after a short interval.

WHISPERING BELLS (*Emmenanthe penduliflora*), a small annual herb of the water leaf family called also golden bells. It is native to chaparral slopes and deserts from southern California and Arizona northward to central California, Nevada and Utah, and sparingly grown in gardens. The erect, much branched stem, about a foot high, with somewhat sticky-hairy herbage, bears deeply cut leaves and cream-colored flowers on short, hairlike, pendulous stalks. The withered flowers, which persist after fruiting, emit a slight whispering sound when stirred by the wind.

WHIST, a card game developed in England in the early part of the 17th century from several older games. The first complete set of rules was published in 1863 by Cavendish (Dr. Henry Jones). These rules were further amended in 1883 by Nicholas B. Trist of New Orleans, La., who contributed the American system of leading from strong suits. An American Whist League, founded in 1891, meets annually.

The regular game involves four persons in partnership, using a full pack of 52 cards. Preliminary formalities include the cutting of the pack before the first deal, the two highest playing against the two lowest and the passing of the deck to the right of the dealer to be cut before each deal. Two packs should be used, one shuffled by the dealer's partner, while the other is dealt. Each player receives 13 cards, dealt singly, from the dealer's left. The last card, turned face upward before the dealer, where it remains until his turn to play on the first trick, establishes the trump suit. The first lead is made by the player at the dealer's left, and the other three play in rotation, following suit if possible. Otherwise they may trump or discard. The first trick is taken in by the winner's partner and laid face downward, the winner then leading to the next trick. Thus the game continues until the 13 tricks are played. The score is 7 points for a game, each trick above 6 counting one.

It is advisable to lead from a strong suit, preferably trumps, and discard from a weak one. Cards rank ace, king, queen, jack, etc. The second player usually, but not necessarily, plays a low card. The third player should take the trick with a low card, if possible, or prevent the fourth player from gaining the trick too cheaply. A low card lead should be made to a partner who has indicated his strong suit. If a player fails to follow suit when he can, he has revoked and must forfeit two tricks to his opponents. Leading out of turn gives either of the opposing partners the right to call for any suit to be led.

Dummy whist is played by three players with the

WHISTLER



"PORTRAIT OF MY MOTHER"

By James Abbott McNeill Whistler (1834-1903). In the Louvre, Paris.

fourth hand laid face upwards on the table. A modification, double dummy, can be played by two persons.

WHISTLER, JAMES ABBOTT McNEILL (1834-1903), American painter and etcher, was born at Lowell, Mass., July 10, 1834. He was dismissed from West Point for deficiency in chemistry and from the Coast Survey Department for sketching heads on the margins of charts. At Paris his first success was the *Little French Series*, etchings published in 1858. In 1863 Whistler established himself at Cheyne Walk, Chelsea, London, where he soon gained a reputation for wit and eccentricity. The influence of Japanese art is seen in the *Princess du Pays de la Porcelaine*, dated 1864, at about which time Whistler began to sign his canvases with the famous butterfly. The

WHITBY, a port and watering-place in the North Riding of Yorkshire, England, situated at the mouth of the Esk, 245 mi. north of London. In the 9th century it was destroyed by the Danes, but later became a Danish colony. The poet Caedmon was a monk of the 7th century abbey which, refounded about 1070, now lies in ruins upon South Cliff. The modern residential section tops West Cliff overlooking the picturesque old fishing village on the steep slopes below. Of some importance during the 12th and subsequent centuries, the ancient town boasts, among other antiquities, St. Mary's Church approached by 199 steps. In the harbor museum are relics of Captain Cook who sailed from Whitby on his first voyage around the world. Ferro-concrete ships were built in



COURTESY METROPOLITAN MUSEUM OF ART

THE ADAM AND EVE, OLD CHELSEA

An etching by James Abbott McNeill Whistler (1834-1903)

Thames Series of etchings, published in 1871, show greater detail than the later *Venice Series*, 1879-93, in which all hard outlines are eliminated. The *Portrait of My Mother*, 1872, in the Louvre, Paris, and the *Portrait of Carlyle*, 1874, at Glasgow, Scotland, are also less abstract than the later harmonies, nocturnes and impressions, in which the emphasis is upon color harmonies rather than form. In America Whistler is best represented in the Charles L. Freer Collection, now in the National Gallery, Washington. As an author Whistler is noted for his *Ten O'Clock*, published 1888, a trenchant statement of his artistic theories, and for *The Gentle Art of Making Enemies*, 1890. The artist died at Chelsea, July 17, 1903. See also ETCHING; PAINTER-ETCHER.

BIBLIOGRAPHY.—E. and J. Pennell, *Life of James McNeill Whistler*, 1911; A. E. Gallatin, *Portraits of Whistler*, 1918.

the yards during the World War, and wooden ships still are built while rope and sail making, and whale fishing, established in 1753, are carried on. Pop. (of district and town) 1921, 12,510; 1931, 11,441.

WHITBY, SYNOD OF, an ecclesiastical council held in 664 at Whitby, Yorkshire, England, at the call of Oswy, King of Northumbria, to decide on the questions of tonsure and the date to observe Easter. The Church tradition of the king was Celtic, while that of the queen was Roman, and each kept Easter differently. A full account of the council is given by Bede and the discussion led to the triumph of the Roman party. The king finally settled the discussion: "I dare not longer contradict the decrees of him who keeps the doors of the kingdom of heaven."

WHITE, ANDREW DICKSON (1832-1918), American educator and diplomat, was born at Homer,

N.Y., Nov. 7, 1832. He graduated from Yale University in 1853 and the following year studied at the Sorbonne. From 1854-55 he was attaché to the United States legation at St. Petersburg, but spent 1855-56 at the University of Berlin. In 1857 he returned to America and was professor of history and English literature at the University of Michigan until 1863, and lecturer in history from 1863-67. He introduced the German seminar method of teaching at this university. In 1867, when EZRA CORNELL founded Cornell University, White was made president and had a large part in formulating the original plans of the institution. In 1872 he introduced coeducation at Cornell in the face of considerable opposition. He served as president until 1885 and during the same period was professor of history. Later he gave the university his historical library, containing over 20,000 volumes, and contributed generously to its support.

White was as well known as a diplomat as an educator. He was United States minister to Germany 1879-81 and to Russia 1892-94. From 1897-1903 he was ambassador to Germany. In 1899 he was chairman of the American delegation to The Hague Peace Conference. His books include *A History of the Warfare of Science with Theology in Christendom*, 1896; *Seven Great Statesmen in the Warfare of Humanity With Unreason*, 1910; and his autobiography, 1905. He died at Ithaca, N.Y., Nov. 4, 1918.

M. R.

WHITE, GILBERT (1720-93), English naturalist and writer, was born at Selborne, July 18, 1720. He was educated at Oxford and in 1747 was ordained in the Church of England. He was appointed to a curacy at Selborne, his native parish, in 1751. He later received other ecclesiastical appointments, but finally returned to Selborne in 1784. He led there a quiet life, alternating parish duties with long walks, gardening, and the study of botany, keeping a minute journal of all his observations. In 1789 his *Natural History and Antiquities of Selborne* was published. It enjoyed much success and was frequently reprinted. White died at Selborne, June 26, 1793.

WHITE, HUGH LAWSON (1773-1840), American politician, was born in Iredell County, N.C., Oct. 30, 1773. He moved with his parents in 1785 to that part of North Carolina which now is Knox County, Tenn. In 1792, he participated in the expedition against the Cherokees under General Sevier. He pursued classical studies in Philadelphia in 1794 before studying law in Lancaster, Pa. He was admitted to the bar in 1796 and began practice in Knoxville, Tenn. He served as a judge of the State Supreme Court, 1801-07, and in the State Senate, 1807-09. In 1808, he was appointed United States District Attorney, and from 1809-15 he was again a judge of the Supreme Court. He was chosen president of the State Bank of Tennessee, 1815, and was again a State Senator, 1817-25. He was elected as a Democrat to the United States Senate to fill the vacancy caused by the resignation of Andrew JACKSON in 1825 and re-elected in 1829 and 1835, serving from October 28,

1825 to Jan. 13, 1840 when he resigned because he could not conscientiously obey the instructions of the Tennessee legislature. He was chosen President pro tempore of the Senate, Dec. 3, 1832 upon the resignation of vice-president Calhoun. As an anti-Jackson candidate for the presidency in 1836, he received the electoral votes of Tennessee and Georgia. He died in Knoxville, Tenn., April 10, 1840.

WHITE, STANFORD (1853-1906), American architect, was born in New York City, Nov. 9, 1853. He studied architecture under C. D. Gambrill, and then worked with H. H. Richardson in designing Trinity Church, Boston. In 1878 he went abroad for further study. Upon his return he joined Charles Follen McKim and William Rutherford Mead in establishing the partnership of McKim, Mead & White, which soon became one of the outstanding architectural firms of the country. Among White's celebrated buildings in New York were the Madison Square Garden (now demolished), the Tiffany and Gorham buildings, the Century and Metropolitan Clubs, and the Madison Avenue and Judson Memorial churches (the former demolished); he also designed the Washington Arch, in Washington Square, and the pedestal for St. Gaudens's statue of Farragut in Madison Square, as well as those of other statues by the same sculptor. He was killed in New York City, June 25, 1906.

WHITE, STEWART EDWARD (1873-), American author, was born at Grand Rapids, Mich., Mar. 12, 1873. He was graduated at the University of Michigan, 1895, and attended Columbia Law School. He soon deserted law for literature, producing many articles and books, his principal works being adventure stories for boys. White's publications include *Westerners*, 1901, *The Magic Forest*, *Arizona Nights*, *African Camp Fires*, *The Leopard Woman*, *Simba*, *Skookum Chuck*, *Back of Beyond*, 1927, *Dog Days*, 1930, and *Shepper-Newfoundler*, 1931.

WHITE, WILLIAM ALLEN (1868-), American author and journalist, was born in Emporia, Kan., Feb. 10, 1868. He was educated in the public schools and the University of Kansas, which he left before graduation to take up newspaper work. In 1895 he bought *The Emporia Gazette*, which he made an influential paper. His books of short stories and sketches, among them *The Court of Boyville*, *Strategems and Spoils*, *In Our Town* and *God's Puppets*, are colorful portrayals of life in the small towns of the Middle West. His novels, *A Certain Rich Man* and *In the Heart of a Fool*, have been very successful. White has also written biographies of Woodrow Wilson and Calvin Coolidge.

WHITE ANT, a name commonly applied to termites, because of their color and their resemblance in form and habits to true ants. See **TERMITE**.

WHITE ARMY. The appellations, Whites, White Guards, were originally applied by the Bolsheviks to the military organizations of their more conservative opponents. Sections of the former Imperial Army

resisted Bolshevik direction as early as Nov., 1917. The release by General Dukhonin of all generals implicated in Kornilov's conspiracy against Kerenski, freed numerous senior officers, among them Kornilov and Denikin, who were thus able to join Admiral Alexeyev's anti-Bolshevik volunteer army in the south. In the spring of 1918, the Czechoslovak corps in Russia threw off Bolshevik control and began hostile operations along the Volga, where a section of the Social-Revolutionary party also organized a short-lived military success, while another volunteer army was formed in Siberia and eventually came under the command of Admiral Kolchak. Upon Kornilov's arrival in the South, in consequence of his large and enthusiastic following among the ex-imperial officers, he soon took the leadership from Alexeyev; Kornilov's death from a bomb in Apr., 1918 then opened the command to Denikin, who accomplished relatively little before the general Armistice of Nov., 1918. By the spring of 1919, however, the southern Whites had made considerable progress in the direction of Moscow, and in the autumn of the same year a northern offensive under Yudenich was within striking distance of Leningrad. Incompetent leadership, however, and pronounced inability to win the confidence of the civilian and peasant population in occupied territory was a constant source of weakness to the White forces. The disinclination of the Allied Powers to render effective support likewise handicapped their efforts. As a result, Trotzky's new Red Army grew in power while his White opponents weakened, and after the Soviets made peace with Poland in Sept., 1920, the various White forces were rapidly removed from the scene.

S. H. C.

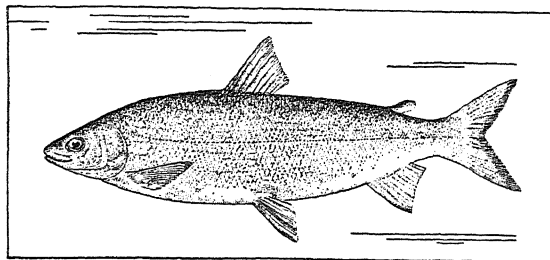
WHITE ARSENIC. See ARSENIC TRIOXIDE.

WHITE DWARF, the name given to a STAR of high temperature, of very low total intrinsic brightness, and generally of very high density.

WHITEFIELD, GEORGE (1714-70), English religious leader and founder of the Calvinistic Methodists, was born at Gloucester in Dec. 1714. While studying at Oxford, he was the friend of John and Charles WESLEY, and in 1736 became a deacon. After preaching to enthusiastic crowds in London he went to Georgia, in America, in 1738. Upon his return to England the same year he was refused admittance to the churches, and had to preach in the open air. In 1739 he again visited America and carried on his work from Georgia to New York. Whitefield returned to England, where he founded the Calvinistic Methodist Society after differing with Wesley. Upon his seventh visit to America he died and was buried at Newburyport, Mass., in Sept. 1770.

WHITEFISH, the common name for a genus (*Coregonus*) of excellent food fishes of the SALMON family (*Salmonidae*) found widely in the northern hemisphere chiefly in clear lakes and streams. They have slender flattened bodies, 1 to 3 ft. long and bluish-olive above and silvery below, cone-shaped heads, and small usually toothless mouths. The largest and most valuable species is the common whitefish (*C. clupea-*

formis). This is one of the finest flavored fishes of interior American waters, occurring in lakes from New England to Lake Superior and northward to the arctic circle. It often attains a length of 2½ ft.



COMMON WHITEFISH

and a weight of 4 lbs. Its food consists chiefly of deep water crustaceans, mollusks and insects. The annual catch of this fish in the United States and Canada is approximately 30 million lbs. valued at about \$3,000,000. Another important species is the Rocky mountain whitefish (*C. williamsoni*), a small species abundant in lakes and streams from the Rocky mountains to the Pacific coast. The latter will rise to a fly like a trout and is highly esteemed by sportsmen.

WHITE FLY, any insect of the family *Aleyrodidae*, closely related to scale insects. Several species attack citrus fruits; others are serious pests in greenhouses, and one species infests strawberry plants. Injury results from the sucking of the sap from the leaves and, in the case of citrus fruits, from the honey-dew produced. A sooty black fungus develops on this, which interferes with the functioning of the leaves and impairs the value of the fruit. The adults are minute insects possessing four wings. Their wings and bodies are covered with white powder. The larvæ, active at first, soon become quiescent. They are flattened, oval, scale-like creatures. A pupa stage is usually recognized. In greenhouses fumigation with hydrocyanic gas is the best control. Where fumigation is not feasible, spraying with oils is recommended.

WHITEHALL, formerly a palace in Whitehall Street, London. Known originally as York House, the palace was the residence of the archbishops of York from the 13th century till 1529, the year of Wolsey's downfall, when, passing to Henry VIII, it became Crown property. It was thenceforward the royal palace—the scene of many stirring historic events—until destroyed by the fires of 1691 and 1697. All that survived the fires is the Banqueting Hall, built in 1619-22 by INIGO JONES, the first English building constructed on purely Palladian lines and the first in England to be built of Portland stone. The ceiling of the Hall—which since 1895 has housed The Royal Service Museum—contains a notable series of paintings by RUBENS, representing the apotheosis of James I, various allegorical subjects, and scenes from the career of Charles I. Whitehall is also a street in London extending from Charing Cross to Westminster, noted for the many government offices

which occupy it. Situated in Whitehall Street are the Admiralty, the War Office, Treasury, Home Office, Dominions and Colonial Offices, India Office and others. The celebrated Horse Guards are also in Whitehall.

WHITEHALL, a village in Washington Co., northeastern New York, situated at the head of Lake Champlain, east of Lake George, at the northern terminus of the State Barge Canal system, 65 mi. northeast of Albany. It is served by the Delaware and Hudson Railroad. Farming and dairying are the chief interests in this region. The principal manufacture is silk yarn. The village was founded as Skenesborough in 1759. It was named Whitehall in 1786 and incorporated in 1806. During the War of 1812 Whitehall was a fortified supply base for American forces. Pop. 1920, 5,258; 1930, 5,191.

WHITEHEAD, ALFRED NORTH (1861-), English-American philosopher and mathematician, was born Feb. 15, 1861 at Ramsgate, Isle of Thanet. He was a fellow at Trinity College, Cambridge, and from 1885-1911 was lecturer on mathematics in that institution. From 1911-14 he was at University College, London, and the following 10 years was professor of applied mathematics in the Imperial College of Science. In 1924 he became professor of philosophy in Harvard University.

Whitehead may be classified as a realist with an idealistic bent. He has been influenced largely by the concept of relativity and regards nature as composed of events in a space-time continuum. Relation is a more important category than quality. The philosophy of organism is worked out and much use is made of the creative principle. A degree of indeterminism is accepted and an intellectualism added to Bergson's vitalism. God becomes the principle of creativity. Whitehead has gained recognition as a philosophical interpreter of modern science.

Whitehead's writings in mathematics are: *A Treatise on Universal Algebra*, 1898; *An Introduction to Mathematics*, 1911, and *Principia Mathematica*, with Bertrand Russell, 1910-13. The following are his most important philosophical works: *The Philosophy of Natural Knowledge*, 1919; *The Organization of Thought*, 1916; *The Concept of Nature*, 1920; *The Principles of Relativity*, 1922; *Science and the Modern World*, 1925; *The Aim of Education*, 1928; *Process and Reality*, 1929, and *The Function of Reason*, 1929.

WHITEHEAD, WILLIAM (1715-85), English poet laureate, was born at Cambridge, and baptised Feb. 12, 1715. He was educated at Cambridge, and in 1750 became a fellow of his college, Clare Hall. While at the university he published *On the Danger of Writing Verse*, and other poems. In 1757 he was appointed Poet Laureate to succeed COLLEY CIBBER. The *School for Lovers*, produced at Drury Lane in 1762, was the most successful of his dramas, and his poem, *Friendship*, is one of his best known productions. Other publications are *The Pathetic Apology of All Laureates* and a farce entitled *Trip to Scotland*. Whitehead died in London, Apr. 14, 1785.

WHITEHILL, CLARENCE EUGENE (1871-), American baritone singer, was born at Marengo, Ia., Nov. 5, 1871. He studied singing under Sbriglia at Paris, making his début at Brussels, in 1900. In 1903-08 he was leading baritone at the Cologne Opera. His début at the Metropolitan Opera, New York, was made in 1909. Since 1920 he has been a regular member of the company, appearing most successfully in Wagnerian rôles.

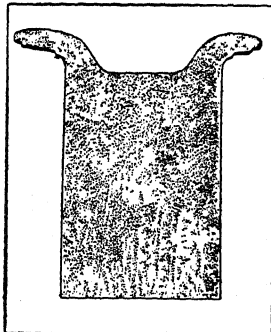
WHITE HOUSE, also called the Executive Mansion, the residence of the President of the United States in Washington, D.C. It is situated on the upper end of the 14 acres of landscaped park that surround it, facing Pennsylvania Avenue.

The plans of James Hoban were selected from many others in an open competition. The architecture is in the Italian Renaissance style with the porticoes supported by Ionic columns, said to have been copied from a Dublin lodge, seat of the Dukes of Leinster. The cornerstone was laid Oct. 13, 1792. Using Acquia Creek Virginia sandstone painted white for the exterior, building continued but progress was slow due to the lack of funds. President John Adams and his wife, in Nov. 1800, became the first occupants of the White House though but six of its rooms were finished. During the War of 1812 it was badly damaged by the British. It was remodeled and improved by Hoban and further improvements were made in 1902 by the firm of McKim, Mead & White. The Executive offices were built and steel was substituted for the wooden frame.

The public is admitted to certain rooms of the White House (at present only the East Room), through the esplanade leading to the Executive Office. Along the basement corridor are portraits of the presidents' wives. A broad stairway leads to the main floor and the East Room, decorated in gold and white, where State receptions were held. Other well known rooms of state are the Blue, Green and Red rooms, which take their names from the predominating color of the walls, and the State Dining Room, panelled in dark English oak and decorated with heads of American big game. The second floor is for the living quarters of the President and his family.

WHITE LEAD, a white pigment of chemical formula $2\text{PbCO}_3 \cdot \text{Pb}(\text{OH})_2$ known to the ancients and one of the earliest chemicals manufactured. Because of its hiding power, aging properties and ease of application when incorporated in oil to form paint, it remains today one of the important paint pigments.

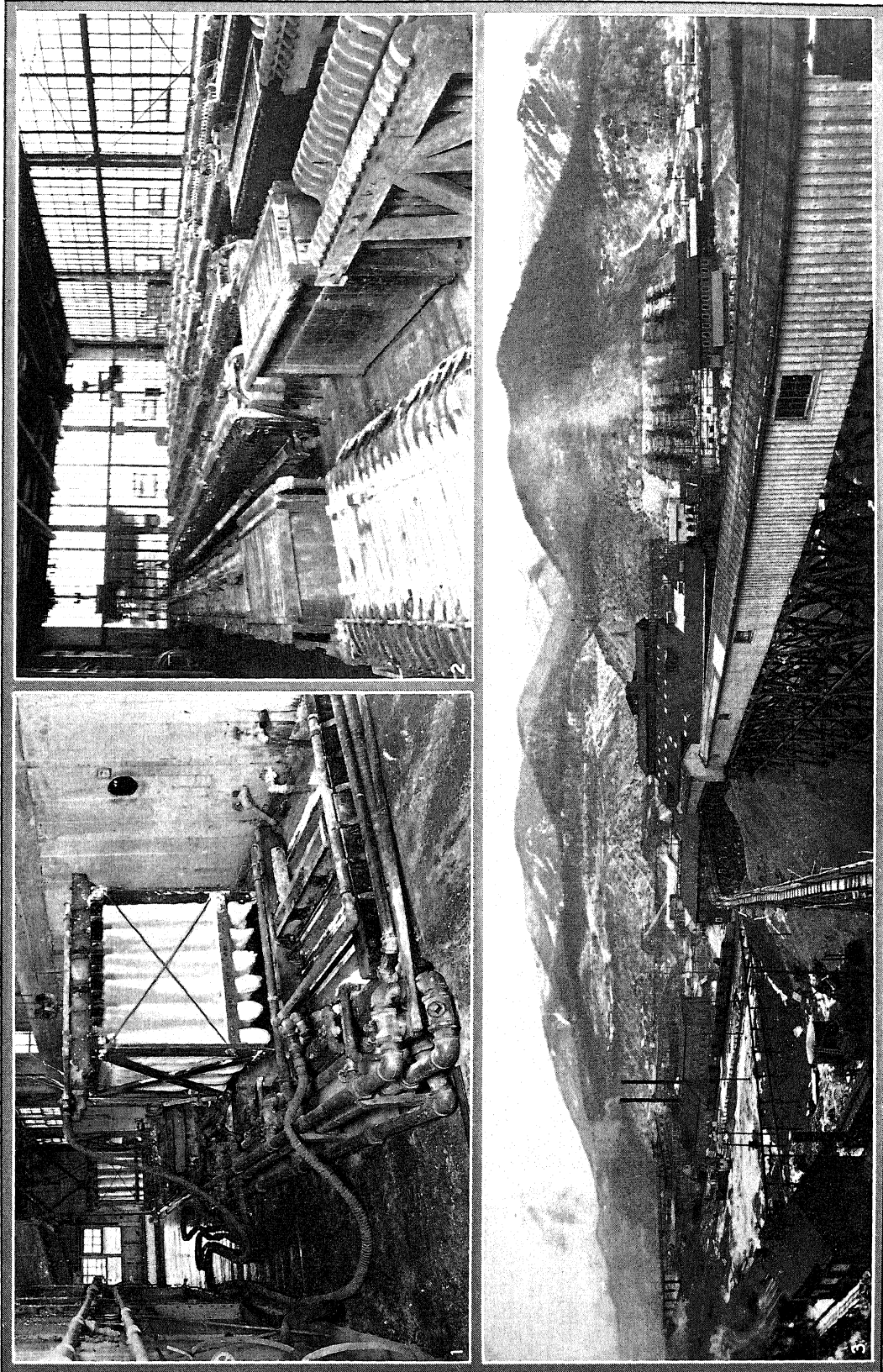
By the Old Dutch commercial method of manufacture, perforated lead discs are suspended in earthen-



COURTESY INTERNATIONAL LEAD REFINING CO.

REFINED LEAD ANODE, USED IN PRODUCING ELECTROLYTIC WHITE LEAD

WHITE LEAD

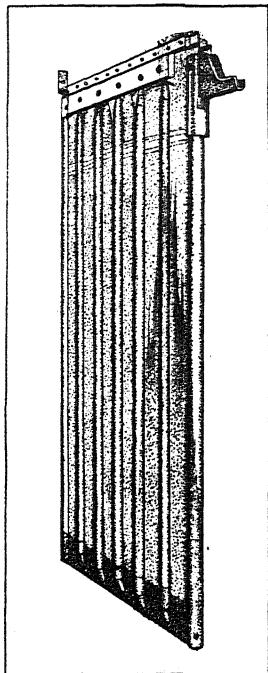


1, 2, COURTESY INTERNATIONAL LEAD REFINING CO.; 3, IDAHO CHAMBER OF COMMERCE

THE MANUFACTURE OF LEAD AND ITS PRODUCTS

1. Filter room, Anaconda Lead Products Co., showing basic carbonate white lead suspended from crane.
2. Electrolytic cell room, Anaconda Lead Products Co.
3. Panoramic view of Bunker Hill Lead Mills, Kellogg, Idaho.

ware pots containing dilute acetic acid. The fermentation of spent tanbark piled in layers between tiers of these pots liberates carbon dioxide, and increases the temperature enough to volatilize the acetic acid. Acid



COURTESY INTERNATIONAL LEAD
REFINING CO.

CATHODE FRAME, USED IN
PRODUCING ELECTROLYTIC
WHITE LEAD

fumes corrode the lead, forming basic lead acetate which reacts with the carbon dioxide to form white lead. When the corrosive action is complete, the white lead is washed, disintegrated, ground in oil or pulped in water, dried and barreled. By the Carter process, lead shot is repeatedly corroded in revolving wooden drums by the action of steam, dilute acetic acid and carbon dioxide. By the electrolytic process, a lead anode is corroded in a cell having an iron cathode completely surrounded by a linen diaphragm. Separate electrolytes composed of sodium acetate and sodium carbonate circulate about each electrode. The current causes the lead to dissolve continually, forming basic lead acetate which is precipitated as white lead by the sodium carbonate. (See ELECTROLYSIS.)

White lead is used chiefly as lead-in-oil or as a base for mixed paints. It is also used as a constituent of ceramic glazes, for producing dry colors and in rubber compounds. F. O. C.

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WHITELEY, WILLIAM (1831-1907), English merchant, born at Agbrigg, Yorkshire, Sept. 29, 1831. After a clerkship in a draper's establishment, he opened a drapery shop in London in 1863. He kept expanding his business until he had a large general store, the first of its kind in London, and his annual profits were almost one-half million dollars. He was shot and killed, Jan. 23, 1907, by a personal enemy.

WHITE MOUNTAIN APACHE, formerly the Sierra Blanca Apache, a division of the Coyoteros (see APACHE) whose principal home was the mountainous region between San Carlos Creek and the Gila River in eastern Arizona. The name is now applied to all the Apache Indians, consisting of members of many bands, gathered under the Ft. Apache Agency in Arizona.

WHITE MOUNTAINS, a division of the Appalachian system in eastern United States, situated in northern New Hampshire. They are remarkable for their rugged and picturesque scenery and are a favorite health and pleasure resort. The range covers 1,270 sq. mi. in Coss, Grafton and Carroll counties and is

divided into two sections by CRAWFORD NOTCH, part of the valley of the Saco River. To the northeast of this notch is the Presidential Range, so called because its peaks are named for United States presidents. To the southwest are the Franconia Mountains. The loftiest summits occur in the Presidential group, including Mt. Washington, 6,293 ft., the highest peak in the Appalachians north of North Carolina; Adams, 5,805 ft., Jefferson, 5,725 ft. and Madison, 5,380 ft. The greatest altitude in the Franconia section is Mt. Lafayette, 5,270 ft. There are in all 86 summits, few of which are really peaks; the mountains generally have no Alpine features. The summit of Mt. Washington is reached by a mountain railroad. The crest line and slopes are carved by erosion into high ridges and deep gorges which provide uncommonly picturesque scenic effects. There is Kings Ravine on the northern slope of Mt. Adams; Lake of the Clouds 5,000 feet above the sea; and, most famous of all, Franconia Notch south of Mt. Lafayette with the flume, pool, Lost River and the Great Stone Face projecting over Profile Lake. In 1928 this area was acquired by the state for a park. Many other sections are protected by the White Mountain National Forest Preserve including in 1930 about 522,000 acres.

WHITE PLAINS, a city of southeastern New York, the county seat of Westchester Co., situated on the Bronx River, about midway between Long Island Sound and the Hudson River, 18 mi. north of New York City, of which it is a restricted residential suburb. The New York Central and the New York, Boston and Westchester railroads, bus lines and an airport serve the city. In 1929 the value of the few manufactures was about \$3,000,000; the retail trade amounted to \$38,014,467. The surrounding country is noted for picturesque scenery and magnificent homes and estates. Among the places of interest is the site, marked by a monument, where the Declaration of Independence was first officially read in New York. When the Dutch settled Manhattan, the site of White Plains was a granary for the Mohican Indians. Early traders named the place because of numerous groves of white balsam. Connecticut Puritans made the first organized settlement in 1683, and the Battle of White Plains took place here in 1776. White Plains received a village charter in 1866 and in 1918 was incorporated. Pop. 1920, 21,031; 1930, 35,830.

WHITE PLAINS, BATTLE OF, Oct. 28, 1776, an engagement of the REVOLUTIONARY WAR. Gen. Washington, anticipating that the British under Gen. Howe would attempt to cut off the possibility of his retreat from Harlem Heights up the Hudson, reinforced Ft. Washington, on the Hudson near the Harlem River, and entrenched his army along a line from Harlem north to White Plains. Howe sent 4,000 troops from Throg's Neck on the East River, toward the northern outpost of Washington's line. The Continental force at White Plains met the attack, and after a furious battle temporarily maintained its position with a loss of 90 men. The British suffered 300 casualties. A memorial tablet was erected in White

Plains in 1925 to indicate the position of the Revolutionary Army on Chatterton's Hill.

WHITE RACE. See RACES OF MANKIND: *Caucasoid Group*.

WHITE RIVER, the largest tributary of the Wabash, formed by the junction of two branches, the East Fork and the West Fork, near Petersburg, Ind. Its headwaters rise in eastern Indiana, the East Fork in Bartholomew Co. and the West Fork in Randolph Co., both at an elevation of about 1,000 ft., and flow southwestward across the state. Both are considerably longer than the trunk stream which measures only 30 mi. in a direct line from the junction of the forks to its mouth. It empties into the Wabash just above Mt. Carmel. The forks have considerable fall and afford good water power which has not been developed to any extent because of the abundance of cheap fuel nearby. Indianapolis is situated on the West Fork. The White River drains about half of the Wabash drainage basin in Indiana.

WHITE RIVER, a tributary of the Missouri, rising in the extreme northwestern part of Nebraska. It flows northeastward into South Dakota, traversing the Bad Lands, after which it flows eastward to join the Missouri at the southeastern extremity of Lyman Co. Of its tributaries the largest is the South Fork. Throughout its course of about 330 mi. the stream flows mostly through rolling prairies and fertile farm lands. The Pine Ridge Indian Reservation is situated near its middle reaches.

WHITE RUSSIA, or White Russian S.S.R., smallest of the seven constituent republics forming the U.S.S.R., or Soviet Union. Its area of 48,940 sq. mi. is bounded by the Ukraine on the south, Poland and Lithuania on the west and the western section of the R.S.F.S.R. on the north and east. Over four-fifths of its citizens are White Russians, descended from three tribes of Eastern Slavs. Jews comprise 8.2% of the total, and other nationalities are Great Russians, 7.7%, Ukrainians .7%, and Poles 2%. One-sixth of the population resides in urban communities, and of these almost half are Jews. Jews and Poles have resided here for many centuries. The White Russians have preserved their national culture and dress, and White Russian is the official language.

The country is physically picturesque and colorful, with lofty hills crowned by dense forests, numerous lakes, wide river valleys, rocky stretches and low-lying morasses. A mild climate prevails. The soil, clay in general, is excellent for the growing of flax, hemp, wheat, oats, barley, potatoes and other produce. There is also extensive live-stock breeding, but agriculture is the principal occupation. About 50,000 persons are employed in State industries. Leather, bristles, matches, veneer and timber are leading articles of export.

The extension of education since the Revolution of 1917 has been very rapid, as is evidenced by the presence of eight universities and numerous schools. Illiteracy is decreasing rapidly. Minsk, the principal city, is also the capital and has a population of over

130,000, and other urban centers are Vitebsk, Mogilev, Bobruisk and Gomel. The country is intersected by railways and good roads are general. Pop. 1931, 5,246,400.

WHITE SEA, a narrow arm of the Arctic Ocean, extending into northern Russia. On the north it forms the Gulf of Kandala and on the south the gulfs of Dvina and Onega. Its greatest depth is 700 ft. The rivers Dvina, Onega and Mezen empty in it. The principal port is Archangel. Fish, particularly herring and cod, abound. There is considerable traffic on this sea, although most of the year it is frozen.

WHITE SHIP. Henry I of England had one son, William. Returning from Normandy in 1120, William's vessel, the white ship, lagged behind the rest of the Royal fleet and, excited with wine, the young nobles chased away the priest who had come to give the customary blessing. In the end, 50 oarsmen drove the vessel hastily seawards. The ship struck a rock and sank. There was but one survivor.

See the poems *The White Ship* by Rossetti and *He Smiled Again* by Mrs. Hemans.

WHITE SLAVE TRAFFIC, the procurement and transportation of women and girls for purposes of prostitution. The campaign against this international traffic in women originated in the latter half of the 19th century upon the initiative of such able crusaders as the English Mrs. Josephine Butler and William Alexander Coote, and the Swiss Pastor T. Borel. The first International Congress for the Suppression of the White Slave Traffic was held at London through the zeal of various voluntary organizations, and soon thereafter an International Bureau for the Suppression of the Traffic in Women and Children was created. At the behest of this Bureau, the French Government convened regular diplomatic conferences in Paris in 1904 and 1910 to find ways and means of dealing with the problem officially. A general agreement was drafted at the first conference and a convention adapted at the second. Up to Jan. 1920, unfortunately, only 16 states had become parties to the agreement, and only 9 to the convention.

By Article 23(c) of the Covenant of the League of Nations, however, that body is entrusted with "the general supervision over the execution of agreements with regard to the traffic in women and children." In the summer of 1921, accordingly, delegates from 34 states met at the invitation of the League Council in an "endeavor to secure a common understanding between the governments with a view to united action." A final act, designed to amplify and strengthen the conventions of 1904 and 1910 was adopted, and at the second assembly of the League, later in the same year, this act was made the basis of another international convention. By 1929, 34 states had ratified the latest document, which raised the age of consent of the women, assigned stricter punishments for violations of the relevant laws, improved the machinery of extradition, and set up more efficient means of exchange of information. The League Council also appointed an advisory committee on the traffic in women

and children. Under the supervision of the League, and with the aid of \$75,000 from the American Bureau of Social Hygiene, a committee of experts enquired into the extent and characteristics of the traffic in Europe, North Africa, and the Americas. An exhaustive report was rendered in 1927. The tenth assembly of the League voted to extend the investigation to the Far East, and with the aid of another liberal contribution (\$125,000) from the American Bureau of Social Hygiene, the wider task was inaugurated in 1930-31. The best source for the study of the traffic is constituted by the various reports of the League's Advisory Committee on the Traffic in Women and Children. An able summary of the entire question is contained in Rolande Beyer's *Un aspect de l'activite sociale de la Société des Nations: la traite des femmes* (1926). W. C. L.

WHITEWASH, a cold water paint. The usual process of manufacture is to mix slaked lime or whiting with a solution of glue. CASEIN is sometimes added to increase binding properties. Calcimines are prepared with gypsum or whiting as the pigment base.

WHITEWOOD, a name given to numerous trees yielding light colored or white wood. In the United States the term is applied especially to the TULIP TREE, the BASSWOOD and the CORRONWOOD, widespread in the eastern states, and also to *Drypetes diversifolia*, a small tree of the spurge family with milky white bark, and to *Schæpfia chrysophylloides*, a slender tree of the olax family with pale gray branches, both confined to southern Florida. In other countries various trees are likewise called whitewood, as the linden and wayfaring-tree in Great Britain and the cheesewood (*Pittosporum bicolor*) in Australia.

WHITING, a name applied in the United States to fishes of two separate families, the hakes (*Merlucciidae*) and the kingfishes (genus *Menticirrhus* of the *Sciaenidae*). The whiting or silver hake (*Merluccius bilinearis*), somewhat resembles the cod, but lacks barbels. It occurs from Newfoundland to Cape Cod and further south in deep waters. A common European whiting (*M. vulgaris*) is found along the North Atlantic coast to England. Among the kingfishes, the sand whiting (*Menticirrhus americanus*) is abundant on the South Atlantic and Gulf coasts. Its elongated silver-gray body is marked with dark bars. One barbel hangs from the lower jaw. A California whiting (*M. undulatus*) is found in South Pacific waters. The whittings of both families are excellent food fish.

In 1929 the commercial catch of whiting in United States waters, taken almost entirely along the coasts of New England and the Middle Atlantic States, amounted to 17,049,000 lbs. valued at \$287,000. See also HAKE; KINGFISH.

WHITING, a city in Lake Co., in the extreme northwest of Indiana, lying on Lake Michigan, 3 mi. north of Hammond. Steamship lines and four railroads serve the city. The refineries of the Standard Oil Company of Indiana supply the principal industrial activity. The retail trade in 1929 amounted to \$4,959,478. About 20 mi. east is Indiana Dunes State

Park. Whiting was founded in 1881 and chartered in 1903. Pop. 1920, 10,145; 1930, 10,880.

WHITLEY COUNCILS, the colloquial name for the national industrial councils organized in England since 1917 as the result of legislation sponsored in Parliament by the Honorable J. H. Whitley. These councils are deliberative bodies, organized voluntarily by industries on a national scale, including representatives of the employer group and the trade union or employee groups in that industry. Their function is not primarily arbitral in character with reference to industrial disputes. It is rather educational with the emphasis on constructive policies and cooperative activities which will help to strengthen the industry and to improve the relations between employers and workers in it. Their success has varied greatly from industry to industry, depending on the leadership available; and some of those organized have been abandoned. In 1930 about 49 industries were operating such councils; and of these 19 had district councils in addition to the national organizations. O. T.

WHITLOCK, BRAND (1869-), American diplomat and author, was born at Urbana, O., Mar. 4, 1869. He entered newspaper work, serving as political correspondent on the Chicago *Herald*, and from 1893-97 was secretary to the Governor of Illinois, and subsequently clerk in the office of the Secretary of State of Illinois. After 1897 he practiced law at Toledo, O., and from 1905-11 was four times elected mayor of that city. As American Minister to Belgium in 1913 he became an international figure, representing seven countries in addition to his own, and noted for his tactful handling of difficult situations during the German occupation of Brussels. Whitlock is the author of several volumes on politics and economics, and also wrote several novels, including *The Turn of the Balance*, 1907, *Uprooted*, 1926, and *Big Matt*, 1928.

WHITMAN, MARCUS (1802-47), American missionary, was born in Rushville, N.Y., Sept. 4, 1802. He studied in Berkshire Medical Institute at Pittsfield, Mass., and in 1834 was appointed missionary physician to Oregon. He established a station at the site of Walla Walla, Wash. The mission board voted to discontinue the work in 1842, but Whitman made the perilous journey east and persuaded the board to continue the work at his station. He visited Washington to urge upon the government the desirability of retaining Oregon, and on his return he guided a wagon-train of 800 emigrants across the mountains to the Columbia river. On Nov. 29, 1847, Whitman was massacred in an Indian attack on the mission.

WHITMAN, WALT (1819-92), American poet, was born at Huntington, Long Island, N.Y., May 31, 1819, of sturdy English and Dutch stock, and of Quaker parentage. His father, a farmer during Whitman's infancy, later took up carpentry as a trade; and in 1824 the family removed to Brooklyn, N.Y., where Walt grew up, and where, until 1830, he attended the public schools. The rest of his teens was spent chiefly in learning and practising the compositor's trade, though for nearly 2 years, 1836-38 he was a well-liked

if not very successful country school-teacher. Several years of drifting followed, during which Whitman printed a newspaper of his own at Huntington, began writing both fiction and verse, played some part in practical politics in Brooklyn and New York City, and irregularly plied his trade as printer. In 1846-48 he was editor of the Brooklyn *Daily Eagle*, for which he wrote many editorials voicing Jacksonian and nationalistic sentiments; but he left the paper owing to a break over the slavery issue. In 1848 a short experience on a newspaper in New Orleans, La., gave him a glimpse of the old South, and a leisurely return-trip north and east made him acquainted with the raw, energetic life of the Mississippi Valley. This was followed by about a year of editing on the Brooklyn *Freeman*, and then, for 6 years, Whitman's life ceases to be easy to trace in detail.

Gradually during these apparently aimless and drifting years, a purpose had been forming in Whitman's mind; and now he set himself to the task of realizing it. Convinced of a prophetic mission, Whitman purposed to write a truly prophetic book expressing in free and unconventional form the meaning of American life as it had revealed itself to him in his rough-and-ready contacts with all sorts and conditions of people, including omnibus-drivers, printers, farmers, mechanics, and the like; to sing the song of triumphant democracy, not in the spirit of European literary culture, but in the spirit of Western freedom and individuality. In 1855 he published at his own expense the first version of this song in a thin volume of un-metrical but eloquent poems, *Leaves of Grass*; and in 1856, in the teeth of indifference or ridicule, but encouraged by the hearty approval of his master, RALPH WALDO EMERSON, he published a second much enlarged version. From the beginning the butt of attacks directed against either his want of sense or his want of taste, and even against his want of moral decency, Whitman resolutely and untiringly devoted the rest of his career to advertising his mission and therefore himself to expanding and enriching his prophecy, and to enlarging and re-publishing his book.

The Civil War was the great turning-point of his career. Into the poetic advocacy of the Union cause Whitman threw himself with all his capacity for zeal. In 1865 appeared *Drum-Taps*, a volume of war poetry, later incorporated in *Leaves of Grass*, and including the great elegy on Lincoln, "When Lilacs Last in the Dooryard Bloomed." Meanwhile, Whitman had been taking part in the vast struggle in a more direct and personal way. From 1862 until some months after Lee's surrender, virtually all his time and energy were given to his self-appointed task as "wound-dresser" or visiting nurse in the military hospitals in Washington, D.C. Here, as he felt, he cemented in blood his mystic affiliation with American democratic manhood; here he certainly contributed incalculably to the recovery of many a sick or wounded soldier; and here he undoubtedly exposed himself to the infection which later undermined his hitherto superb health.

The first few years after the war were spent in Washington, first at a post in the Interior Department from which he was dismissed on account of his "immoral" book, and later in the Attorney General's office. In 1871 Whitman published the prose *Democratic Vistas*; and in 1873, after occasional attacks of ill-health, he was finally stricken by a partial paralysis which forced him to resign his government post, and to retire to his brother's home in Camden, N.J. Here the rest of his life was spent in invalidism—a pathetic contrast, in one sense, to the abounding vitality of his earlier years; but, owing to Whitman's unconquerable good spirits, and also to the loyal devotion of the friends who gathered about him increasingly, the last 20 years were far from miserable. Recognition came to him hesitantly but surely; first from younger Americans such as Burroughs and O'Connor, later from such Englishmen as W. M. Rossetti, Swinburne and J. A. Symonds, and ultimately from Continental critics as well. From time to time he published new editions of *Leaves of Grass*. In 1879 he made a trip to Colorado, and in 1880 to Canada. He published in 1882 a volume of delicate prose sketches, *Specimen Days and Collect*, and in 1888 a similar volume, *November Boughs*. From 1884 to the end he lived with great contentment in an extremely plain little house in the dingy Mickle Street, where he received visits from many eminent men and many cranks, and where, after months of physical suffering, he died Mar. 26, 1892.

Easily the most important of American poets, Whitman is to be understood only in terms of the idealistic individualism which he partly learned from Emerson, but which in a truer sense he was born to. His poetry utters first of all the gospel of self-reliant manhood and womanhood, but it is an egoistic gospel corrected by a democratic faith in the "divine average" and by a half-mystical belief in comradeship. To embody in actual society this new equalitarian ideal is undoubtedly the destiny of America, and hence Whitman's prophetic nationalism. Hence, too, his Catholic acceptance of Nature as he finds her, without refinement or embroidery; hence his celebration of the animal body; hence his optimistic acceptance of vice and suffering and tragedy as part of a transcendent whole; and hence, finally, his loving preoccupation with death as the mystical confirmation of life. See also AMERICAN LITERATURE.

N. AR.

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WHITMAN, a town of southeastern Massachusetts, in Plymouth Co., situated about 21 mi. southeast of Boston. The New York, New Haven and Hartford Railroad and buses afford means of transportation. Whitman is essentially an industrial town. Its manufactures include leather, shoes, tacks, blacking and boxes. It was set off from Abington as South Abington in 1875, and changed its name to Whitman in 1886. Pop. 1920, 7,147; 1930, 7,638.

WHITMAN COLLEGE, at Walla Walla, Wash. a privately controlled, coeducational institution. It was founded in 1859 as Whitman Seminary and chartered under its present name in 1882. It was aided by the Congregational Education Society from 1883-1907, when it was freed from denominational control. The grounds and buildings were valued in 1931 at \$488,554. The library contained 46,000 volumes. In 1930 there were 564 students and a faculty of 37, headed by Pres. Stephen B. L. Penrose.

WHITNEY, ELI (1765-1825), American inventor, was born at Westboro, Mass., Dec. 2, 1765. After working his way through Yale, he began to study law, but while residing on the Savannah, Ga., plantation of Mrs. Nathanael Greene, widow of the Revolutionary general, his interest was directed to cotton culture. Whitney saw that the industry was handicapped by the slow and arduous manual labor of separating the cotton from the seed. He set about designing a machine to perform this work, and produced a model, which was simply a wooden cylinder, circumscribed by lines of slender spikes, extending between the bars of a grid in such a manner that the seeds could not pass, but permitted the lint to be caught by the moving spikes. Whitney's first machine, patented in 1794, could clean 50 lbs. of cotton daily, and in partnership with Phineas Miller he began to manufacture cotton-gins at New Haven, Conn. Because the two men were unable to produce sufficient machines to supply the increasing demand, country blacksmiths pirated the design, and Whitney spent large sums in litigation to protect his rights. He enlarged his factory to manufacture firearms, and was awarded government contracts which brought him a fortune. He died Jan. 8, 1825, at New Haven, Conn.

WHITNEY, GERTRUDE VANDERBILT, American sculptor, was born in New York, the daughter of CORNELIUS VANDERBILT. She was educated at Briarley School, New York, and studied sculpture under Henry Anderson and James E. Frazer in New York, and under Andrew O'Connor in Paris. Her principal works are the Aztec Fountain in the Pan-American Building, Washington, D.C.; El Dorado Fountain, San Francisco; and an equestrian statue of Col. William F. Cody (Buffalo Bill).

WHITNEY MUSEUM OF AMERICAN ART, an art museum in New York City, opened in 1931 when Gertrude Vanderbilt Whitney presented to the public her collection of American art. The purpose of the museum is to further the acquaintance and interest of the public in the work of contemporary American artists, as well as to provide through its collection a historical background of earlier American art. To further this purpose, the museum has published a series of monographs on outstanding contemporaries; in addition, it presents lectures and debates on art subjects by authorities, and sponsors other talks for clubs and colleges. The permanent collection consists of 500 paintings in oil and water color, 115 sculptures and 1,000 works in the graphic arts, all by American artists. In forming this collection, which is continually aug-

mented by purchases, special emphasis has been placed on the acquisition of work by living artists. A reading room, decorated with murals by Thomas H. Benton, was opened for reference work on American art in December, 1932.

H. M.

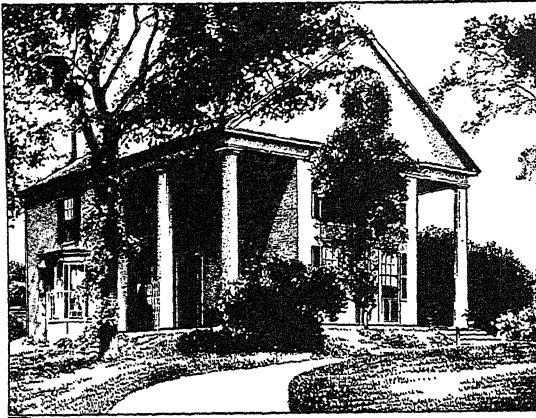
WHITNEY, WILLIAM COLLINS (1841-1904), American capitalist and Cabinet officer, was born at Conway, Mass., July 5, 1841. He graduated from Yale (1863) and Harvard (1865) universities, and began law practice at New York City. In 1871, he helped to organize the Young Men's Democratic Club in New York, and fought against the Tweed Ring. He became corporation counsel in 1875, and he succeeded in making numerous important changes in the law department of the city during his seven-year term of office. He was Secretary of the Navy in 1885-89, under Grover Cleveland, and made sweeping changes which generally strengthened the naval organization. He returned to New York, at the termination of his government office, and formed the Metropolitan Street Railway Company. He died at New York City, Feb. 2, 1904.

WHITNEY, WILLIAM DWIGHT (1827-94), American Sanskrit scholar and philologist, was born at Northampton, Mass., Feb. 9, 1827. He graduated from Williams College in 1845 and, after studying in Germany, was appointed to a chair of Sanskrit at Yale University in 1854. In 1870 he received from the Berlin Academy of Science the first Bopp prize in recognition of his contribution to Sanskrit philology. His publications consisted of nearly 400 titles, among which were *Language and the Study of Language*, 1867, and *Sanskrit Grammar*, 1879. Whitney died at New Haven, Conn., June 7, 1894.

WHITNEY, MOUNT, the highest point in California, occurring near the southern extremity of the high Sierra Nevadas on the border between Inyo and Tulare Co. Its altitude of 14,496 ft. is the highest in the United States outside of Alaska. This mountain was first sighted in 1864 by members of the state geological survey led by Professor Josiah Dwight Whitney for whom the peak was named. At that time Clarence King climbed to within a few hundred feet of its summit. Nine years later the summit was reached by John Lucas, Charles D. Begale and A. H. Johnson, all of Inyo Co. It has been ascended several times since then. From its granite crest strewn with boulders and snow there is an unhindered view in every direction including many spires but little lower than its own. Mt. Williamson measures 14,384 ft. These higher summits are carved and eroded into bold relief by the action of glaciers formerly covering them. Forests of red and white firs and fox-tail pine now climb to nearly 11,000 ft. on the slopes.

WHITTIER, JOHN GREENLEAF (1807-90), American poet, was born in Haverhill, Mass., Dec. 17, 1807, of sturdy Quaker stock. He had little formal education until his 20th year, when he studied for two terms at the Haverhill Academy. His childhood was typically that of a New England country boy. It had few of the adornments of culture, laying com-

plete emphasis on strength of character. The two outstanding literary influences of the poet's youth were the Bible and the poems of ROBERT BURNS. After leaving the Haverhill Academy, Whittier



HOME OF JOHN GREENLEAF WHITTIER AT AMESBURY, MASS.

worked for several years as a printer and journalist in various New England towns. In 1830-31 he edited the *New England Weekly Review* at Hartford, Conn., and from 1837-40 he was editor of the *Pennsylvania Freeman* at Philadelphia. His hatred of Negro slavery early sent him into the ranks of the Abolitionists, and he was the friend of such leaders of the movement as A. W. Thayer and WILLIAM LLOYD GARRISON. In 1833 Whittier signed the National Anti-Slavery Declaration as a delegate from Massachusetts, and in the same year issued at his own expense a widely discussed pamphlet, *Justice and Expediency*. In 1835 he sat in the Massachusetts Legislature. The rest of the poet's life was spent mainly in Essex County, Mass., either in the country or in the villages of Haverhill, Amesbury or Danvers. Whittier died Sept. 8, 1890, at Hampton Falls, N.H., and was buried at Amesbury.

Whittier's poems may be divided into main classes. The first includes his political and religious poems; many of these, directed against slavery, show Whittier perhaps in an admirable light as a reformer, but in general they must be ranked as occasional poems, possessing neither enduring interest nor great literary value. The second and more important group includes his poems on country life, and in these Whittier shows his true worth. He wrote chiefly of his own country in Massachusetts, reminiscing about his own boyhood there, describing husking bees and the New England winter, or writing ballads about some of his townspeople of an earlier day. Among his most notable volumes are *Lays of My Home*, 1843, *Voices of Freedom*, 1846, *Songs of Labor*, 1850, *Home Ballads*, 1860, *National Lyrics*, 1865, *Snow-Bound*, 1866, *The Pennsylvania Pilgrim*, 1872, *The Vision of Echard*, 1878, and *At Sundown*, 1890. He also wrote several books of prose, including *The Stranger at Lowell*, 1845, and *Old Portraits and New Sketches*, 1850. Of all his poems perhaps the best known are

"The Barefoot Boy," "Snow-Bound," "Barclay of Ury," "In School Days," "Telling the Bees," "The Last Eve of Summer," "Barbara Frietchie," "Ichabod," "Skipper Ireson's Ride," and "Maud Muller." Whittier was not a scholar, not a philosopher, and distinctly not a polished poet; but he was one of the most native of American poets, one who could sing of the common things in the right idiom, spontaneously and sincerely.

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WHITTIER, a city of southern California, in Los Angeles Co., lying on a slope of the foothills between the mountains and the ocean, about 13 mi. southeast of Los Angeles. Three railroads and air, traction and bus lines afford transportation. Whittier is in a vast citrus fruit and walnut growing region; in the section are some 10,000 acres of citrus lands and 5,000 acres of walnuts. The avocado is successfully grown. There are factories manufacturing oil well equipment and automobile top dressing, lock works and a clay products plant. Whittier College and a state school for boys are here. The famous Pio Pico home and a meeting house of the Society of Friends, said to be the largest in the world, are located here. The Quakers founded the town in 1887 and named it after John Greenleaf Whittier. Pop. 1920, 7,997; 1930, 14,822.

WHOLE NUMBER, one of the natural numbers used in counting, 1, 2, 3, . . . , n , It is simply another name for the Latin *integer*. It is distinguished from the early term, broken number, used in the 16th century for the Latin *fractio*, fraction, literally a fractured or broken number. See also FRACTION; DIGIT.

WHOLESALE, that portion of trade which distributes a nation's products by placing them in the hands of the retailers. The wholesaler is a distinct and important factor in the working of the economic system. Wholesaling is the machinery which regulates supply and adjusts demand by fitting the vast productive power of the manufacturer to the purchasing power of the consumer. The wholesale buyer does for the nation what the individual buyer does for the individual firm. He has been called the stock-keeper of the trade system. His is the function of initiative by the creation of demand through speculative buying and he acts as a stabilizer between two variables, at the one end extreme production, dependent on labor and raw materials, and at the other the changing demands of the consumer. He extends CREDIT to the retailer in excess of what could be advanced by the producer and also saves the retailer from the trouble and expense of carrying a large number of accounts for special lines. The general wholesaler stocks a complete line of merchandise. Each wholesaler specializes in a narrow range of goods but keeps in stock a large variety. He transfers the cost of keeping large stocks from the manufacturer

to the wholesale warehouseman. He buys goods in large quantities from the producer, warehouses them and resells in smaller quantities to the retailer. Manufacturers have sometimes undertaken the function of distribution and eliminated the wholesaler. When manufacturing and wholesaling are combined economies are undoubtedly secured. A large manufacturer can often sell direct to the retailer profitably but the small manufacturer is unable to do so on account of the expense and extra capital required. See also RETAILING.

WHOLESALE TRADE, UNITED STATES. The Census of 1930 presented for the first time in history comprehensive statistics showing the volume of business transacted by wholesale establishments in the United States. Important details concerning the wholesale trade of the country as a whole and also for the 10 leading states, which together accounted for 71% of the total trade, are set forth in the following table:

WHOLESALE TRADE, U.S., 1929

Division	No. Establishments	No. Employees	Salaries and Wages \$	Net Sales \$	% of Total
United States ..	169,757	1,607,704	3,015,109,766	69,490,771,331	100.0
LEADING STATES:					
N. Y. ...	25,316	291,298	697,121,695	17,664,514,767	25.4
Ill.	11,588	164,563	341,533,487	6,860,820,303	9.9
Penna. ...	10,546	113,737	217,852,219	4,761,812,064	6.9
Calif. ...	9,751	123,053	219,909,186	4,159,323,157	6.0
Mo.	6,674	79,488	145,671,050	3,361,561,643	4.8
Ohio ...	8,078	84,766	154,690,581	3,094,444,580	4.5
Mass. ...	6,067	72,973	146,000,585	3,087,684,593	4.4
Texas ...	9,606	58,989	96,206,700	2,804,509,116	4.0
Mich. ...	5,273	47,424	97,112,780	2,174,202,745	3.1
Minn. ...	5,521	37,498	62,332,561	1,716,943,734	2.5

WHOLE WHEAT FOODS. The wheat kernel consists of an outer coat (bran) which has four distinct layers (the epidermis, epicarp, endocarp and testa), and beneath this the aleurone layer, under which is the endosperm. The latter is made up largely of starch cells, each of which contains protein and starch granules. At one end of the kernel is the germ or embryo.

The difference between whole wheat and highly refined wheat products is due to the removal of the BRAN in milling. Along with the bran proper, the germ and more or less of the aleurone layer may be removed, depending upon the processes used. Most of the indigestible fiber, or cellulose, the phosphorus, iron and vitamins, and some protein are contained in the bran and the germ. The energy value of whole and refined wheat products is almost exactly the same. Whole wheat foods are only slightly less completely digested than finely milled products.

Two typical and commonly used whole wheat foods are graham and entire wheat flours. Graham flour is made by grinding the whole kernel. Entire wheat

flour is made from ground wheat after removal of the bran.

H. T. B.

BIBLIOGRAPHY.—*Cereal Breakfast Foods*, United States Department of Agriculture, Farmers' Bulletin 249; *Cereals and Cereal Products*, Part 9 of Bulletin 13, Bureau of Chemistry, United States Department of Agriculture.

WHOOPIING COUGH, a specific infectious disease due to the *Bacillus pertussis*, which infects the mucous membrane of the wind-pipe, and the bronchi. The infection produces only a little inflammation, but there is increase in the mucous secretion.

The disease is most common during the winter and spring, and often occurs in epidemics. It is found most often in children under six years of age, but no age is immune. One attack of the disease usually protects against further attacks. The disorder is usually contracted by direct contact, through droplets of moisture coughed or sneezed out by the patient. Transmission through infected clothing and indirect contact is probably rare, although it does occur.

The incubation period is usually about a week, but may be from four to fourteen days. The onset is gradual with slight fatigue, running of the nose and moderate cough. There is also slight fever. The cough gradually becomes more frequent and prolonged. In about ten days to two weeks, following a paroxysm of coughing, the breath is drawn in sharply, constituting the typical whoop. In some cases the appearance of the whoop is delayed or it may be entirely absent throughout the disease. The attacks of coughing are worse at night, vomiting frequently following a paroxysm.

Examination of the blood usually shows an increase in the total number of white blood cells with a markedly increased percentage of lymphocytes. They may rise to as high as 80 per cent of the total number of white blood cells.

After three or four weeks, the intensity and frequency of the attacks begin to decrease, and the whoop gradually disappears. The total duration of the disease is usually from eight to ten weeks. The disease is usually contagious for about three weeks after the appearance of the typical whoop. Isolation is usually maintained for at least six weeks.

The complications cause nearly all the fatalities. They consist of capillary BRONCHITIS and BRONCHOPNEUMONIA, collapse of the lungs and, occasionally, dilation of the air sacs in the lungs, that is, the disorder termed EMPHYSEMA. The mortality varies greatly with age. Under one year it is high, and it is considerable under three years of age. Over five years, it is less than 1 per cent.

No specific treatment of value is available. Vaccines for immunization and treatment have been disappointing. Fresh air and sunshine seem to have the most benefit. The meals should be small and frequent. The child should be confined to bed during the first several weeks. Sedatives may be helpful.

W. I. F.

WHORTLEBERRY, a name given in Great Britain to a small, smooth shrub (*Vaccinium Myrtil.*

lus) of the heath family yielding a sweet edible fruit, called also bilberry and blaeberry. It is a native of mountain heaths and woods in northern Europe and Asia often covering large tracts. In America the HUCKLEBERRY and the MOUNTAIN CRANBERRY are sometimes called whortleberry.

WICHITA, a city in central southern Kansas, the county seat of Sedgwick Co. It is situated at the junction of the Arkansas and Little Arkansas rivers, 200 mi. southwest of Kansas; it is served by airplanes, bus and truck lines and seven railroads. Wichita is an important industrial center and is a shipping center for the farm and dairy products of the region. Its principal manufactures are airplanes, clothing, printed matter, paper boxes, farm machinery, flour, meat products, structural iron, bricks, oil field tools and supplies and pharmaceutical supplies. In 1929 the factory output was worth about \$63,000,000; the wholesale trade proper amounted to \$114,458,239, and the retail, to \$81,161,109. Wichita is the seat of the American Indian Institute, the University of Wichita and Friends' University. In its early days Wichita was a trading post. It was settled in 1870 and made a city in 1871. Pop. 1920, 72,217; 1930, 111,110.

WICHITA, MUNICIPAL UNIVERSITY OF, a coeducational institution, controlled by the city of Wichita, Kan. Established in 1896, as Fairmount College and affiliated with the Congregational Church, it was taken over in 1926 by the city and given its present title. It is non-sectarian and is supported by public taxation. The university consists of colleges of Liberal Arts, Fine Arts, Education, Commerce and Engineering. The grounds and buildings were valued in 1931 at \$1,108,071. The library contained 44,000 volumes. In 1931-32 there were 1,300 students and a faculty of 75, headed by Pres. H. W. FOGHT.

WICHITA FALLS, a city and important trading center in northern Texas, the county seat of Wichita Co. It is situated on the Wichita River in a productive agricultural and oil and gas region. Bus lines, airplanes and several railroads serve the city. A large irrigation system, which has as a supply base three lakes, makes the countryside available for dairying, poultry-raising, truck farming and the raising of cotton and wheat. The chief industries are flour, glass and truck manufacturing and the refining of oil. In 1929 the value of the factory output was about \$18,000,000; the retail trade amounted to \$30,581,325. There is good fishing and hunting in the vicinity. Founded in 1874, it was incorporated in 1883. Pop. 1920, 40,079; 1930, 43,690.

WICK, a device used to convey the oil of lamps or the melted tallow of candles to the point where it undergoes combustion. Candle wicks comprise several fibers loosely twisted together and lamp wicks are a loosely woven fabric. Wicks readily absorb liquids and convey them by capillary action.

WICKERSHAM, GEORGE WOODWARD (1858-), American lawyer and public official, was

born in Pittsburgh, Pa., Sept. 19, 1858. He attended Lehigh University during 1873-75 and was admitted to the Pennsylvania bar in 1880. He later moved to New York City, and was admitted to the New York bar in 1883. From 1909-13, as Attorney General in President Taft's cabinet, he directed numerous dissolution suits against large corporations. President Wilson made him a member of his second Industrial Conference in 1919. The Council of the League of Nations appointed him a member of the Committee on Progressive Codification of International Law in 1924. His most recent important work has been as chairman of the National Commission on Law Observance and Law Enforcement to which he was appointed by President Hoover, bringing in two noteworthy reports, upon Prohibition and upon illegal violence by the police.

WIDDEMER, MARGARET, American writer, was born at Doylestown, Pa., and graduated from Drexel Institute Library School in 1909. She shared with CARL SANDBURG the Pulitzer Prize for poetry in 1918. Miss Widdemer's works include *The Rose-Garden Husband*, 1915, *Charis Sees it Through*, 1924, and *All the King's Horses*, 1930, novels; and *Old Road to Paradise*, 1918, *Cross Currents*, 1921, and *Poems, Ballads and Lyrics*, 1925, poetry; also several books for children.

WIDIN. See VIDIN.

WIDGEON (*Mareca penelope*), a species of fresh water duck very abundant in the Old World and fairly common in Alaska and on the Californian coast, but of rare occurrence in the eastern states. It is somewhat larger than a teal, the male having a chestnut head, pinkish neck and breast, gray back and flanks, white underparts and black and white wings with a green band; the female is a more sober reddish brown in coloration. The widgeon feeds largely upon aquatic plants, especially the grass-wrack, and nests on the ground, laying six to ten greenish-buff eggs. The similar American widgeon or baldpate (*M. americana*), which is duller in color with a speckled gray head and white crown, is found practically throughout North America.

WIDOR, CHARLES MARIE (1845-), French composer and organist, was born at Lyons, Feb. 22, 1845. He took up the study of the organ under Nicholas Lemmens, becoming one of the foremost organists of the period, and composition under FRANÇOIS FÉTIS. In 1869 he became organist of St. Sulpice, Paris, in 1890 succeeded CÉSAR FRANCK as organ professor at the Paris Conservatory, where in 1896 he succeeded François Dubois as professor of musical theory. His compositions include a ballet, *La Korrigane*, four symphonies, and a quantity of chamber music, in addition to eight organ symphonies, or sonatas, for which he is chiefly noted as a composer. With Albert Schweitzer he edited a definitive edition of Bach's organ works, and in 1906 published *Technique of the Modern Orchestra*, a supplement to the treatise by H. Berlioz. He was active in the movement, after the World War, to raise the standard of

musical education in the French schools, and in September, 1931, at the age of 86, launched a national campaign to raise the salaries of music professors.

WIELAND, CHRISTOPH MARTIN (1733-1813), German poet and philosopher, was born at Oberholzheim, Württemberg, Sept. 5, 1733, and studied law at the University of Tübingen. His first literary work was a philosophical poem called *Die Natur Der Dinge*, 1752. Among his later poems, *Mausarion*, 1768, is a metrical romance, pleading implicitly for a rational union of the spirit and the senses, and *The New Amadis*, 1771, is a companion piece, celebrating the victory of intellectual over physical beauty. From 1769-72 Wieland was Professor of Philosophy at the University of Erfurt. In 1773 he moved to Weimar, where he edited the important *Deutscher Mercur*, 1773-89, drawing Goethe, Herder and Schiller into his intellectual circle. He translated Shakespeare's plays into German prose, 1762-66, and also translated many Latin and Greek classics. His works have been collected in 45 volumes.

These include the famous psychological novel, *Geschichte des Agathon*, 1766-67, *Verklagter Amor*, or *Cupid Accused*, a defense of love poetry, and *Dialogen des Diogenes von Sinope*, 1770, the author's apology for his philosophical views. Wieland has been called the "German Voltaire" and ranks among the outstanding literary figures of the age. He died at Weimar, Jan. 20, 1813.

WIEN, WILHELM (1864-1928), German physicist, was born at Gaffken, East Prussia, Jan. 13, 1864. He studied under Hermann von Helmholtz, and successively held professorships at Aachen, Giessen and Würzburg, becoming professor at Munich in 1920. His contributions covered nearly the whole domain of physics but he is especially remembered for the Wien, or displacement law in black-body radiation, his formula for the distribution of energy in the radiations of a body at any temperature, and his researches with positive rays (see WIEN'S LAW). He received the Nobel Prize in 1911 and lectured at Columbia University in 1913. He died at Munich, Aug. 30, 1928.

WIENER-NEUSTADT, city in Lower Austria. There is a former castle, now a military academy, the late Gothic church of St. George with the tomb of Maximilian I and a park, a late Romanesque church, a Cistercian cloister, an art gallery and diverse educational institutions. Locomotives, radiators, aeroplanes, iron and leather goods are manufactured. Nearby are two aviation fields. Founded late in the 12th century by Duke Leopold II, Wiener-Neustadt passed for a time into Hungarian hands, was besieged in 1529 and 1683 by the Turks and was rebuilt after a fire in 1834. Pop. 1923, 36,956.

WIEN'S LAW. As the temperature of a BLACK BODY RADIATOR is raised, the total amount of energy radiated from it increases according to STEFAN'S LAW. Simultaneously, the distribution of energy is altered. Relatively more energy is radiated at the shorter wavelengths, and the wave-length at which the energy is emitted becomes shorter as the temperature rises.

WIEN showed that $\lambda_m T = \text{constant}$ in which λ_m is the wave-length of maximum energy and T is the absolute temperature of the source (see ABSOLUTE TEMPERATURE SCALE). This is Wien's Displacement Law. Wien also proposed an equation for the distribution of energy but it has been superseded by PLANCK'S LAW.

WIESBADEN, a German city in the Prussian province of Hesse-Nassau, south of the Taunus Mountains in a wide, hilly valley on the east bank of the Rhine, about 25 mi. west of Frankfort-on-Main. It is regularly built and almost entirely without old buildings. Extensive districts of country houses surround the city. By merging in 1926 with Biebrich, Schierstein and Sonnenberg and in 1928 with nine other neighboring places, it extends to the Rhine. It has a castle dating from 1837, an old museum built from 1812 to 1815, a large Kurhaus and other modern buildings. The oldest structure is the Heathen Wall, the remains of a Roman fortress dating from 300 A.D. It is one of the most famous spas in Germany and has numerous sanatoria. There were 151,841 visitors in 1929. In the new parts of the city are industrial enterprises producing machines, metal wares and chemicals. Wiesbaden has a large trade in wine. There are many schools, learned and artistic societies, libraries and museums, theaters and concerts. A Roman fortified town grew up around the mineral springs about 11 B.C., it became a city during the Middle Ages, from 1815 to 1866 it was capital of the Duchy of Nassau. French troops occupied it from 1918 to 1925. Pop. 1925, 102,737.

WIESER, FRIEDRICH VON (1851-1926), German-Austrian political economist, was born at Vienna, July 10, 1851. He was professor at the universities of Prague and Vienna, and from 1917 to 1919 was Austrian minister of commerce. Wieser is the foremost German representative of the subjective doctrine of value. Among other writings he published *Über den Ursprung und die Hauptgesetze des Wirtschaftlichen Wertes*, *Theorie der Gesellschaftlichen Wirtschaft* and *Das Gesetz der Macht*. He died at Sankt Gilgen am Wolfgangsee, July 23, 1926.

WIFE, PROPERTY RIGHTS. See COMMUNITY PROPERTY.

WIFE OF BATH, THE, a pilgrim in Chaucer's CANTERBURY TALES, noted for her naïve vulgarity. In the prologue to her tale of the Arthurian knight who sought an answer to the question "What does a woman love best?", she gives an extremely frank account of her life and marital experiences.

WIGAN, a municipal borough of Lancashire, England, lying on the small river Douglas which flows into the estuary of the Ribble, 194 mi. northwest of London. The Church of All Saints of Saxon origin and late Perpendicular style is the town's chief antiquity and is greatly restored. The list of mayors is complete since the 14th century and of rectors since the end of the 12th. Coal mines of channel coal are abundant in the vicinity, and local industries include nail, bolt and screw manufactures and linen and cotton weavings. Pop. 1921, 89,421; 1931, 85,357.

WIGGIN, KATE DOUGLAS (1859-1923), American author, was born in Philadelphia, Pa., Sept. 28, 1859, and educated at Abbot Academy, Andover, Mass. In California, where she lived for several years, she organized the first free kindergartens on the Pacific Coast. Subsequently she lived in New York and at Hollis, Me. One of the most popular of juvenal authors, she wrote *The Birds' Christmas Carol*, published in 1888, *Rebecca of Sunnybrook Farm*, *New Chronicles of Rebecca*, the *Penelope* series, *Timothy's Quest* and *Mother Carey's Chickens*, 1911. With her sister, Nora Archibald Smith, she edited various books for children and wrote *Froebel's Gifts*, *Froebel's Occupations* and *Kindergarten Principles*. Kate Douglas Wiggin died in England, Aug. 24, 1923.

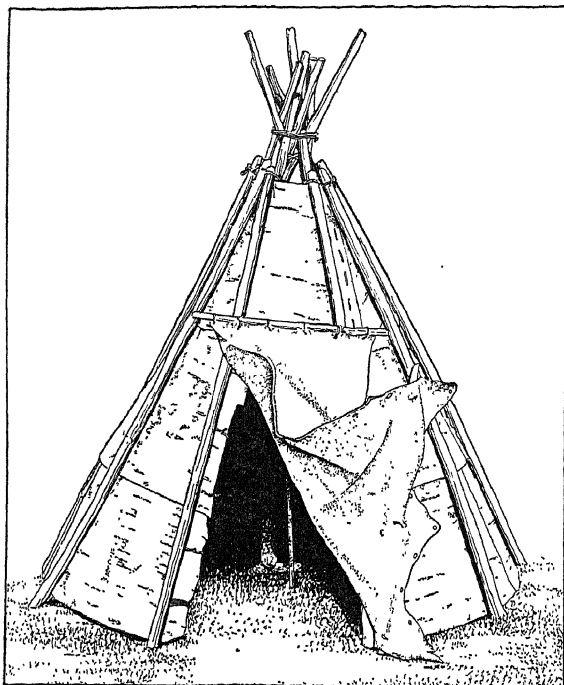
WIGGINS, CARLETON (1848-1932), American painter, was born at Turners, N.Y., Mar. 4, 1848. He studied at the National Academy of Design and under George Inness in New York, and in France. He became the most distinguished painter of cattle and sheep in the United States. Among his paintings are *A Holstein Bull*, in the Metropolitan Museum, New York; *The Plow Horse*, Lotos Club, New York; *October*, Corcoran Gallery, Washington; and *Cattle in Pond*, Brooklyn Institute. He died at Old Lyme, Conn., June 11, 1932.

WIGGINS, GUY CARLETON (1883-), American painter, was born in Brooklyn, N.Y., Feb. 23, 1883. He was a pupil of his father, CARLETON WIGGINS, and of the National Academy of Design, New York. He was made an associate in the National Academy. Wiggins's works include *The Metropolitan Tower*, in the Metropolitan Museum, New York; *Gloucester Harbor*, National Gallery, Washington; *Berkshire Hills—June*, Brooklyn Institute, and *Lightly Falling Snow*, Art Institute, Chicago.

WIGGLESWORTH, MICHAEL (1631-1705), Puritan preacher and poet, was born in Yorkshire, England, Oct. 18, 1631. When seven he was brought to New England, was educated at Harvard and later was a tutor there. He studied theology, and was pastor of the Malden, Mass., church from 1657 until his death, declining the presidency of Harvard because of ill-health. *The Day of Doom*, 1662, is his best-known work. It is a rigidly Calvinistic poem, but was popular in New England for over 100 years. Other works are *Meat Out of the Eater* and *A Discourse on Eternity*. He died at Malden, Mass., June 10, 1705.

WIGHT, ISLE OF, an island in the English Channel, forming a part of Hampshire. It is 13 mi. long and 22 mi. wide, covering an area of about 147 sq. mi. Many tourists visit the island, noted for its rugged scenery of chalk cliffs and deep ravines, and also for its healthful climate. The chief towns are Newport, Ventnor, Yarmouth and Cowes, the scene of famous yacht races. There are roads, railways and three rivers for transportation. Pop. 1931, 88,400. Carisbrooke Castle is located in the Isle of Wight. There are interesting ruins dating from the Roman and Norwegian invasions and many fine churches.

WIGWAM, the Abnaki (Algonkian) Indian word for house, which has erroneously been applied to many forms of American Indian habitations. Actually, however, the name refers only to the dome-shaped



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WIGWAM OF THE MICMAC INDIANS OF NOVA SCOTIA

or conical arbor-like structure used generally by the Algonkian-speaking peoples east of the Mississippi River from Canada to North Carolina. It differed from the Tipi of the Plains Indians in that the covering of the pole framework, instead of being of skins, was of bark, saplings and, in the south, of rushes or flags.

WILAMOWITZ-MOELLENDORFF, ULRICH VON (1848-1931), German classical scholar, was born at Markowitz in Posen, Dec. 22, 1848. He was educated at Bonn and Berlin and after a visit of two years in Italy and Greece, he returned to Germany, and occupied the chair of classical philology at Greifswald in 1876, at Göttingen in 1883, and at Berlin in 1897. He was appointed central director of the Archaeological Institute at Berlin. One of the foremost classical philologists of modern times, he has made many splendid translations from the Greek, and has contributed valuable studies on the Greek drama. Among his numerous works are *Analecta Euripedes* (1875); *Reden und Vorträge* (1902); *Staat und Gesellschaft der Griechen und Römer* (1910); *Aeschyli Interpretationen* (1914); *Griechische Verskunst* (1921); *Geschichte der Griechischen Sprache* (1928); and *Erinnerungen 1848-1914* (1928). He died Sept. 25, 1931.

WILBERFORCE, SAMUEL (1805-73), English bishop, was born at London, Sept. 7, 1805. He was

graduated from Oriel College, Oxford. After his ordination in 1828, he became rector of Brightstone, Isle of Wight, in 1830. He held various other ecclesiastical posts until 1845 when he was made Bishop of Oxford. In that position he exerted a great influence on the life and affairs of the nation. His publications include *Notebook of a Country Gentleman*, *Eucharistica*, and a *History of the Protestant Episcopal Church in America*. He died near Dorking, Surrey, July 19, 1873.

WILBERFORCE, WILLIAM (1759-1833), British statesman and philanthropist, was born at Hull, Aug. 24, 1759. Educated at Cambridge, he entered Parliament in 1780, retaining his seat until ill health forced his retirement in 1825. He became interested in the slavery question about 1787, and in 1789 proposed its prohibition in Parliament, the law coming into force in 1807. He next took steps for the abolition of slavery, and after several years' work the Emancipation Bill was passed by Parliament in 1833. Besides his activities in the slavery question, he was interested in religious and various parliamentary reforms. Wilberforce died in London, July 29, 1833, and was buried in Westminster Abbey.

WILBERFORCE UNIVERSITY, a coeducational institution for Negroes at Wilberforce, O. It was founded in 1856, and is an outgrowth of the first organized effort in the United States, begun in 1847 near Columbus, O., by the African Methodist Episcopal Church, to secure education for the Negro. Dr. Richard Rust was its first president. The university comprises collegiate, normal, theological, law, academic, music and commercial departments, and a nurses' training school. The grounds and buildings were valued in 1931 at \$1,702,070. The library contained 12,900 volumes. In 1930-31 there were 1,438 students and a faculty of 73, headed by Pres. Gilbert H. Jones.

WILBUR, RAY LYMAN (1875-), American statesman, was born at Boonesboro, Iowa, on Apr. 13, 1875. He graduated from Stanford University in 1896. Four years later he obtained his medical degree at Cooper Medical College, San Francisco, and continued his medical studies in London, Frankfurt and Munich. He was professor of medicine at Stanford University from 1909-16, when he was appointed president. During American participation in the World War, Wilbur was chief of the Conservation division, United States Food Administration, later associating himself with international commissions studying health, child welfare, illiteracy and race relations. In 1923 he was appointed a trustee of the Rockefeller Foundation, and in 1923-24 was president of the American Medical Association. Wilbur entered the Cabinet of President Hoover on Mar. 4, 1929 as Secretary of the Interior, being given a leave of absence from Stanford University.

WILCOX, ELLA WHEELER (1855-1919), American poet, was born in 1855 at Johnstown Centre, Wis., of New England parentage. She was educated in rural schools and at the University of Wisconsin.

In 1884 she married Robert M. Wilcox. Her first book, *Poems of Passion*, appeared in 1883 and established her reputation. Mrs. Wilcox traveled extensively, and went to London in 1901 to write her impressions of Queen Victoria's funeral. The poet settled in the East, and, besides publishing a few novels, wrote poetry for the daily press over a long period of years. A poet of the people, she wrote of everyday things in a spirit of helpfulness and optimism. Most representative of her work are *Poems of Pleasure*, 1887; *Poems of Sentiment*, 1906; *Poems of Progress*, 1910; *Lest We Forget*, 1915, and *World Voices*, 1916. Mrs. Wilcox died at Short Beach, Conn., Oct. 30, 1919.

WILDE, OSCAR FINGALL O'FLAHERTIE WILLS (1856-1900), Irish poet, playwright and author, was born in Dublin, Oct. 15, 1856. He was educated at Trinity College, Dublin, and later at Oxford, where his eccentricities and affectations were very marked. He became known as the apostle of the doctrine of "art for art's sake," and his sparkling wit and intellectual brilliancy attracted much attention in London society. In 1882 Wilde lectured in the United States. He wrote poems, fairy tales and in 1891 a novel, *The Picture of Dorian Gray*. (See *DORIAN GRAY*.) His first outstanding success was his comedy, *Lady Windermere's Fan*, produced in London in 1892. It was followed by *A Woman of No Importance*, *An Ideal Husband* and *The Importance of Being Earnest* all characterized by Wilde's scintillant wit. In 1895 he brought an action for libel against the Marquis of Queensberry, and as the outcome of this suit he was sentenced to 2 years' hard labor for offences against morals. While in prison he wrote *The Ballad of Reading Gaol*, and a notable prose work, *De Profundis*. After his release Wilde lived in France under the name of "Sebastian Melmoth." He died in poverty in Paris, Nov. 30, 1900.

WILDER, THORNTON NIVEN (1897-), American novelist, was born at Madison, Wis., Apr. 17, 1897. He was educated in California, in China, at Oberlin College and at Yale. In 1920 he was a graduate student at the American Academy in Rome. He later became a schoolmaster at Lawrenceville School, N.J., and while there began to write. His first novel was *The Cabala*, 1925, and his second, *The Bridge of San Luis Rey*, 1927, created a sensation. In 1930 Wilder published *The Woman of Andros*.

WILDERNESS, BATTLE OF THE, May 5-6, 1864, a desperate engagement of the CIVIL WAR, the first battle in which Generals Grant and Lee were the opposing commanders. On May 3 the Union army crossed the Rapidan, advancing against Lee's force of 60,000 near Fredericksburg, Va., traversing a heavily thicketed region called the Wilderness. Lee struck before the enemy had emerged from the Wilderness, sending forward divisions under Generals Longstreet, Ewell and A. P. Hill, against divergent points of the Union line. The battle was largely a hand-to-hand conflict between companies and squads,

the nature of the country precluding the massing of regiments. Toward the close of the first day, Generals Sedgwick and Hancock had apparently defeated the opposing Confederates; but before dawn Longstreet, having rallied Hill's division, reached the flank of Hancock's division by a detour. In the morning he attacked; but his column was mistaken for a Federal force by other Confederates and fired upon, Longstreet being seriously wounded. Elsewhere in the Wilderness the fighting was sanguinary but indecisive. Federal losses were 17,666; the Confederate loss, about 10,000. During the night of May 6-7 Lee's army withdrew.

WILDERNESS ROAD, THE, built by Daniel Boone and associates, Mar. 10-Apr. 6, 1775, was the first and leading highway of pioneer travel across the Allegheny Mts. into Kentucky. Richard Henderson, head of the Transylvania Company, secured Boone to guide his party of emigrants into the wilderness of Kentucky. Boone headed an advance group which set out from the Holston River and Powell's River for Cumberland Gap. The party blazed the way with hatchets and hacked out the underbrush. The road, as marked out by Boone, halted at the confluence of the Kentucky River and Otter Creek, in the bluegrass region. It was later extended to the Ohio River, and a branch extended into southern Kentucky. As used by thousands of emigrants, the road properly began at Ft. Chissel, at the eastern base of the Blue Ridge, at which point it formed a junction with a road from Philadelphia and another from Richmond.

WILD HUNTSMAN, THE, a legendary ghost who is supposed, with his pack of spectral dogs, to haunt the Black Forest in Germany, the Forest of Fontainebleau in France, and who is identified in England with Herne the Hunter. According to one legend, the Wild Huntsman is a Jew who grossly insulted Christ, refusing to let Him quench his thirst at a horse-trough. He is mentioned in Shakespeare's *Merry Wives of Windsor*, and is the subject of a ballad, *Der wilde Jäger*, by G. A. Bürger, translated by Sir Walter Scott, 1796.

WILDWOOD, a seashore resort city of Cape May Co., N.J., situated on a strip of sand beach separated from the mainland by a tidal basin, 70 mi. south of Philadelphia, Pa., and 32 mi. southwest of Atlantic City, N.J. It is served by the Pennsylvania and Reading railroads and motor bus lines. Noteworthy features are its broad, sandy beach, boardwalk and numerous hotels; boarding houses and cottages accommodating many thousands of summer residents. Pop. 1920, 2,790; 1930, 5,330.

WILEY, HARVEY W. (1844-1930), American chemist, born in Kent, Indiana, Oct. 18, 1844. He was educated at Hanover (Ind.) College, Indiana Medical College and Harvard. He served as state chemist of Indiana and professor of chemistry at Purdue University (1874-1883) and in 1883 he became chief of the Bureau of Chemistry in the U.S. Department of Agriculture, and professor of agricultural chemistry at George Washington University. Dr.

Wiley's name will always be associated with protection against the exploitation of adulterated foods and poisonous drugs, being an influential proponent of the Pure Food and Drugs Act and a rigid enforcer of the bill, which was passed in 1906. He resigned his position with the Government in 1912, and devoted his time to writing, becoming associated with *Good Housekeeping Magazine*. In addition to some 60 Government pamphlets and several hundred scientific papers, he wrote many popular volumes on foods and edited a series of Health Readers for Schools. *See also* PATENT MEDICINE. M. F.

WILEY COLLEGE, a coeducational institute for the education of Negroes, at Marshall, Tex., was founded in 1873 by the Freedman's Aid and Southern Educational Society of the Methodist Episcopal Church. It is chiefly supported by this organization. The school gives instruction in elementary, preparatory and collegiate work, as well as in commercial and industrial courses. The grounds and buildings were valued in 1931 at \$305,400. There were 12,200 volumes in the library. In 1931-32 there were 768 students and a faculty of 31, headed by Rev. M. W. Dogan, president.

WILHELMINA (1880-) Queen of the Netherlands, was born at The Hague, Aug. 31, 1880. She was the only daughter of William III of the Netherlands whom she succeeded in 1890 under the regency of her mother, Queen Emma, daughter of Prince George Victor of Waldeck. Wilhelmina became Queen regnant Aug. 31, 1898. She was crowned at the New Church in Amsterdam, Sept. 6, 1898 with great celebration and rejoicing and has been an exceedingly popular and greatly beloved queen. On Feb. 7, 1901 she married Duke Henry of Mecklenburg-Schwerin and on Apr. 9, 1909 Princess Juliana, heir to the Dutch throne, was born.

WILHELM MEISTER'S APPRENTICESHIP, a novel by GOETHE; published 1796. Wilhelm Meister, the emotional pampered son of a wealthy business man, serves his apprenticeship to life in two distinct stages of experience. In the first he leads a wildly bohemian life with a troupe of actors, the chief episode of this period being that of his love affair with Marianne, a young actress. Wilhelm next enters the society of highly cultured people, meanwhile learning many lessons from his illegitimate son, Felix. In the end, feeling that he has found a meaning in life through his varied experiences, he marries a titled lady and becomes a landed proprietor.

WILHELMSHAVEN, German naval base and watering place in the Prussian province of Hanover about 45 mi. from Bremen. It is on the Jade Gulf into which the Ems-Jade Canal flows. Prussia purchased the site in 1854 from Oldenburg. There are schools for seamen and officers, a commercial harbor, deep-sea fishery, naval shipyards and drydocks, great machine shops, foundries and allied plants, together with minor industries. Pop. 1925, 25,403.

WILKES, CHARLES (1798-1877), American navy officer and explorer, was born in New York City,

Apr. 3, 1798, and at twenty entered the navy. In 1830 he was put in charge of the naval bureau of charts and instruments and in 1838 commanded a four-year exploring expedition in the South Pacific and Antarctic, visiting, among other places, the South Sea Islands, Australia, the Philippines and Hawaii. Of this trip he made a voluminous report. During the Civil War he was given active command, and on Nov. 8, 1861, took the Confederate commissioners, Mason and Slidell, off the British ship *Trent*. In 1862 he was made commodore and stationed in the West Indies to protect American commerce. In 1866 he was made rear-admiral, and retired. He died in Washington, Feb. 8, 1877.

WILKES, JOHN (1727-97), English political reformer, was born in London, Oct. 17, 1727. He entered politics and in 1762 established the *North Briton*, a political journal whose bitter diatribes against influential figures in politics caused his arrest in 1763 and his expulsion from the House of Commons in 1764. His case won considerable sympathy from leading Whigs as well as from liberal opinion all over England, and a celebrated contest arose between the electors of Middlesex and the Ministry. Four times in succession Wilkes was elected to the House of Commons by Middlesex, and four times his election was rejected by Parliament. The cause of Wilkes became synonymous with the cause of liberty and the people of London and Middlesex showered their political favors upon him. He was elected alderman of London and later, in 1774, became Lord Mayor of London. From 1774-90 he represented Middlesex in Parliament. Wilkes died Dec. 26, 1797. Wilkes-Barre, Pennsylvania, is named after him.

WILKES-BARRE, a city in the anthracite coal-mining region of northeastern Pennsylvania, the county seat of Luzerne Co. It is situated on the Susquehanna River, 100 mi. northwest of Philadelphia. Airplanes, bus and truck lines and seven railroads serve the city. The beautiful Wyoming Valley in which Wilkes-Barre is built is the greatest anthracite field in the country. The city has been called the second largest silk center in the country. Iron, steel, tobacco and textile mills are located here. In 1929 the total factory output was worth about \$41,000,000; the retail trade amounted to \$57,840,667. Wilkes-Barre was settled in 1770 and incorporated as a city in 1871. It was burned to the ground by the enemy during the American Revolution and also during the second Pennamite-Yankee War. The city is named for John Wilkes, an English sympathizer for American independence in American Revolution days, and for Col. Isaac Barre, like Wilkes a member of the English Parliament and outspoken against England's policies in ruling the thirteen colonies. Pop. 1920, 73,833; 1930, 86,626.

WILKIE, SIR DAVID (1785-1841), Scottish painter, was born at Culter, Fifeshire, Nov. 18, 1785. He studied at the Trustees' Academy, Edinburgh, and at the Royal Academy, London. In 1811 Wilkie became a member of the Royal Academy, and painted

among other works, *Reading the Will*, *Chelsea Pensioners* and the *Highlander's Home*. In 1830 he was appointed painter to the king. Wilkie died on ship-board off Gibraltar while returning from a visit to the East, June 1, 1841.

WILKINS, ERNEST HATCH (1880-), American educator, was born in Newton Center, Mass., Sept. 14, 1880. He was educated at Amherst, Johns Hopkins and Harvard. Wilkins taught Romance languages at Amherst from 1900-04, at Harvard from 1906-12, and was professor in the same subject at the University of Chicago from 1912-27 as well as being dean of the colleges of Arts, Literature and Science in 1923-26. In 1927 he became president of Oberlin College. He is the author of *Dante—Poet and Aposile* and *The Trees of Genealogia Deorum*.

WILKINS, SIR GEORGE HUBERT (1888-), British explorer, was born at Mt. Bryan East, South Australia, Oct. 31, 1888. After a course in engineering at the Adelaide School of Mines he became an aeronautical photographer. During the World War he was a captain in the Australian Flying Corps. He went to the Antarctic with the British Imperial expedition, 1920-21; and again to the Antarctic, 1921-22, with Sir Ernest Shackleton. Wilkins, with Lieut. Carl Ben Eilson, flew 2,100 miles from Pt. Barrow, Alaska to Spitzbergen in 20½ hours in Apr., 1928, and in December of the same year, flew with Eilson from Deception Island south across Graham Land in the Antarctic. Early in 1930, Wilkins came to the United States, and obtained from the Navy Department a submarine, which he intended to use on an expedition to the Arctic. After several delays he started early in 1931, but on reaching Norway it was found inadvisable to continue, and the expedition was abandoned.

WILKINS, MARY ELEANOR. See FREEMAN, MARY ELEANOR WILKINS.

WILKINSBURG, a borough of Allegheny Co., Pa., a residential suburb about 5 mi. east of Pittsburgh. It is served by the Pennsylvania Railroad, motor bus lines and two nearby airports. In 1929 its manufactured products were approximately valued at \$2,000,000; the retail trade amounted to \$14,286,257. Settled in 1798, Wilkinsburg became a borough in 1887. Pop. 1920, 24,403; 1930, 29,639.

WILKINSON, JAMES (1757-1825), American soldier, was born in Calvert Co., Md., in 1757. He entered the army at the outbreak of the REVOLUTIONARY WAR, in 1775, serving under Gen. BENEDICT ARNOLD in the campaign against Quebec. He acted from May, 1777 to March, 1778 as adjutant-general of the Northern department. Promoted to the rank of brigadier-general in 1778, he resigned his commission almost at once because of his detected implication in the CONWAY CABAL against GEORGE WASHINGTON. Upon reëntering the army, Wilkinson was clothier-general from July, 1779 until March, 1781. After the war he moved to the west, where he settled at the Falls of the Ohio (later Louisville) in 1784. He was active for several years in the agitation to de-

tach the southwest from its allegiance to the United States.

Wilkinson gained an audience with the Spanish governor of Louisiana at New Orleans in 1787 and Spanish archives later revealed that Wilkinson took an oath of allegiance and was on the secret payroll of Spain. A man of shifting loyalties to all governments, he was no more faithful to Spain than to the United States, secretly plotting in various ways to betray either or both of his countries for his personal enrichment. Washington with misgivings commissioned Wilkinson a lieutenant-colonel in the army, 1791. Promoted to brigadier-general in 1792, he participated in the Indian campaigns of Gen. Arthur St. Clair, 1791, and of Gen. ANTHONY WAYNE, 1794.

Wilkinson in 1803 was one of the commissioners to receive Louisiana from France and in 1805 he became governor of the region north of Orleans Territory (later Louisiana). Wilkinson continued his incessant intrigues, full knowledge of which has never been disclosed. He may have had an ulterior motive in sending Lieut. ZEBULON M. PIKE to explore the southwest and in 1805-06 he plotted for an, as yet, unknown purpose with AARON BURR. For some unexplained reason, Wilkinson in 1806 became alarmed, notified THOMAS JEFFERSON of Burr's plans and declared martial law in New Orleans. Burr was acquitted before the Supreme Court at Richmond, Va., in 1807 and his fellow-conspirator was later subjected to a series of courts-martial and congressional investigations from which he emerged unscathed. He was restored to his command in 1812. In 1813 he occupied Mobile for the United States and was promoted to the rank of major-general. He bungled the campaign against Montreal in 1813 and was once more court-martialled. The military court exonerated him but the episode ended his military career. He retired to his plantation near New Orleans until Mexico gained her independence in 1821 when he proceeded to Mexico City, as did other Americans, probably in quest of a favorable land grant from the new government. There he died, Dec. 28, 1825.

WILL, a legal document directing the disposition of property, effective only at the death of the maker. In a will, gift of land is known as a devise, one of money or of personalty is called a bequest, or commonly a Legacy. The maker of a will is called the *testator*, the *beneficiaries* are *devisees* or *legatees*, and the one named in the will to carry out its intentions is called the *executor*. Witnesses to a will are known as *attestors*.

Execution and the Formalities. In most states of the United States wills must not only be in writing, but must be signed by the testator, and the signature must be signed in the presence of at least two attestors, who must subscribe the will in the presence of the testator. In about one-fourth of the states a will wholly written by the hand of testator and "holographic" or signed by him is valid without attestation.

The proper order of events is: first, the preparation

of the will, then testator's signature, then the signatures of the attestors. The signature must be made in the presence of the attestors, or else they must hear the testator acknowledge his signature, and in many jurisdictions must be actually present, and must subscribe at the same time in the presence of the testator. If they are in another room, so that the testator cannot behold their performance, their act is insufficient. A will is distinguishable from other legal instruments by this test only. "Was it intended to transfer the testator's property at death and to be freely revocable until then?"

A will may be valid though it contains no introduction, no testimonium clause and no attestation clause, though these are commonly present. It must contain the dispositive part, the signature of the testator and, unless it is holographic, the signatures of the attestors. The attestors must receive nothing under the will when they subscribe. Some statutes also require that the testator publish to them the fact that the instrument is a will.

By the doctrine of incorporation by reference, it has become established that the entire will need not be present at the time of execution, provided that such absent part is already in existence and is referred to clearly and unmistakably as being existent. A famous illustration is the case of *Bryan's Appeal*. Mr. Bryan was to draft Mr. Bennett's will. One provision was, "I give to my wife fifty thousand dollars for purposes set forth in a sealed letter which will be found with this will." There was nothing to show that the sealed letter found with the will was written prior to the execution of the will, so it could not be incorporated by reference.

A will may be brought down to date by a *Codicil*—an addition to the will which requires the same formalities for its validity as a will. A will republished by codicil may have a meaning due to external circumstances that it did not originally bear. Thus, the testator may leave a legacy to Mrs. Eli Ellis, Pleasant Avenue, Walden, N.Y. Suppose that when the will is executed the Mrs. Ellis then living was named Mary. Mary died and Ellis thereafter married Susan. If a later codicil republishes the will, the testator knowing of the death of Mary and the marriage to Susan, Susan should take the legacy originally intended for Mary.

Revocation and Revival. A will may be revoked by the execution of a later will, or by burning, tearing, cancelling, obliterating, mutilating or otherwise destroying it if the testator has the *animus revocandi*, or intention of revoking. But the intention must be accompanied by such appropriate act. A revoked will may be revived by codicil; revival by the revocation of the revoking will is possible in some jurisdictions.

Mental Capacity must be present in order to execute a valid will. It is defined about as follows: A person, to have capacity to execute a will, must have mind and memory enough to understand the ordinary affairs of life, the value, extent and nature

of his property, the persons who are the natural objects of his bounty, their deserts with reference to their treatment of him, and their needs; and be able to frame his own plan of disposition of his property.

Mistake, Fraud, Undue Influence may invalidate a will otherwise formally correct. The testator's error as to the identity of the instrument or as to its contents is fatal, unless the contents were read over to him and courts cannot reform a will to make it read as it was intended. Clauses omitted cannot be inserted, but clauses erroneously inserted may perhaps be omitted if the omission would not affect other dispositions. Mistakes of law or of fact which induce the execution do not affect the will. Fraud, however, vitiates as much of the will as it affects.

Undue influence does not vitiate a will unless it amounts to coercion. The influence of wife or children exercised through entreaty is not "undue" unless the testator is made to express a will which he does not desire, but cannot resist. A. E. E.

WILL, FREEDOM AND TRAINING OF THE, the process by which habits are organized for intelligent action. Freedom of the will does not mean free will in the sense of the free will controversy; it simply means that habits are adequate to the situation with which the individual may be confronted. For example, you are not free to play the piano if you do not know how to play this instrument. But if you happen to know how to play it and have access to one, you are free with reference to playing the piano. Training is required for freedom in any activity that must be learned. This involves the principles of habit formation. Yet there are situations in which habit is not sufficient. Such situations may be illustrated by cases involving the necessity for deliberation and choice. At times one has to choose between alternatives. If these alternatives are important, action must be delayed until consequences can be duly weighed. A person who acts impulsively where reflection is required often experiences regrets later. His action has not been intelligent with reference to the situation. Habits of thought and deliberation are not part of man's native equipment. They are the result of training and education. Yet it should be noted that one cannot think habitually. Nevertheless good thinking habits often are the only habits that will set one free.

The distinction between good and bad habits is based on their ability to help or hinder intelligent functioning. By intelligent functioning is meant efficiency in meeting the problem with which one is confronted. Good habits enable the individual to control the situation, whereas bad habits control him and prevent him from functioning adequately for the problem. Good habits set him free; bad habits enslave him.

Intelligent action often requires that the response be delayed, but it also requires that decision be made at the proper time. It is good sense to wait until one is in possession of the facts, but a man of good judgment must also know when he has enough facts

to warrant a decision. Too impulsive action or vacillation in decision are not marks of intelligent action. This is a matter of training the will so that it will be free in a given situation.

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WILLAMETTE RIVER, a river of Oregon, formed by the confluence of the McKenzie and Middle Fork which rise in the Cascade Range and unite in Lane Co., about 10 mi. north of Eugene. This stream flows northward and empties into the Columbia about 100 mi. from the sea. Including the Middle Fork, it is 294 mi. long and drains an area of 11,000 sq. mi. of picturesque farming and fruit-growing country. Its channel has been improved to provide steamboat traffic between Portland and Corvallis the entire year, and between Corvallis and Harrisburg nine months of the year. Lumber, paper pulp, fuel and food products are the principal products carried on this stream. The river has a fairly uniform slope except at Oregon City where there is a drop of 41 ft.

WILLARD, EMMA HART (1787-1870), American educator, was born at Berlin, Conn., Feb. 23, 1787. In 1802 she attended Berlin Academy and from that time until she married Dr. John Willard, 1809, alternated teaching and studying. During the winter of 1805 she was a student at the Misses Patten's school in Hartford and during the spring and autumn of 1806 studied at Mrs. Royse's school. From 1807-09 she was principal of a girls' academy in Middlebury, Vt. In 1814, due to financial reverses, she opened a girls' boarding school, called the Middlebury Female Seminary, in her own home. During the next few years, determined that greater educational opportunities should be offered women, she worked on her Plan for Improving Female Education and in 1819 sent this to Gov. Clinton of New York. As a result she was asked to move her school to Watertown, N.Y., in 1821, this being moved later to Troy, where it was called Troy Female Seminary (now Emma Willard School). In 1830, while touring Europe, she helped to found a girls' school in Athens, Greece, and donated to it the proceeds from her book, *Journal and Letters from France and Great Britain*, 1833. She wrote several textbooks and one book of poems, *Rocked in the Cradle of the Deep* being the most widely known. She died at Troy, N.Y., Apr. 15, 1870. In 1905 she was elected to the Hall of Fame.

See A. Lutz, *Emma Willard—Daughter of Democracy*, 1929.

WILLARD, FRANCES ELIZABETH (1839-98), American temperance reformer and educator, was born at Churchville, N.Y., Sept. 28, 1839. After graduating at the Northwestern Woman's College in 1859, she became a teacher and in 1871-74 was dean of the Woman's College, which became a part of Northwestern University in 1873. She began her active temperance work in 1875, as corresponding secretary of the National Woman's Temperance Union, founded in that year, of which she was president from 1879 until her death. In 1883 she founded the World's W.C.T.U., serving as president for 15

years. An executive and organizer of marked ability, with an amazing capacity for work, she was also a brilliant orator and a prolific writer. In her campaign against the liquor traffic, Miss Willard delivered thousands of lectures, visiting every large town and every state in the Union, and also addressed many audiences abroad. She edited several temperance periodicals, wrote numerous articles on prohibition, suffrage for women, and labor problems. She was the author of *Nineteen Beautiful Years*, *Women and Temperance*, *How to Win*, and other works. In 1890 she was elected president of the Women's National Council of the United States. Miss Willard died in New York City, Feb. 18, 1898, and in 1910 was elected to the Hall of Fame.

WILLET (*Catoptrophorus semipalmatus*), one of the larger North American shore birds closely allied to the sandpipers. It is 15 to 17 in. long, with brownish gray and white summer plumage and grayish winter plumage. Frequenting marshes, shores and beaches in flocks, it breeds in Nova Scotia and from Virginia to Florida and the Bahamas and winters southward to Brazil and Peru. It flies with rapidity and grace and when alarmed utters a loud, whistling, often repeated "pilly-will-willet." Nesting in grassy marshes, it lays three to four spotted buffy eggs. A larger, paler form, the western willet (*C. s. inornatus*), occurs chiefly in southern Canada and the western states, and, during migration, along the Atlantic and Gulf coasts.

WILLIAM I, THE CONQUEROR (1027?-87), King of England, was born in Falaise, Normandy, in 1027 or 1028, the illegitimate son of Robert, Duke of Normandy, by the daughter of a tanner. Robert having no legitimate heir, at his death in 1035, William succeeded to the duchy, though only over several revolts by his turbulent barons. In 1051 William, now thoroughly established in Normandy, visited his second cousin, the childless Edward the Confessor, King of England, and in later times William insisted that Edward had promised him the crown of England, something which Edward had no power to do. In 1063 Harold, Earl of Wessex, member of the powerful house of Godwin, and presumptive successor to Edward, visited Normandy and William said that Harold had sworn on holy relics not to attempt succeeding Edward.

Finally in 1066 Edward died and William, putting forth his doubtful claims to the English crown, for which he had now received the approval of Pope Alexander II, set sail for England with an army estimated between 25,000 and 60,000, composed mostly of the smaller Norman gentry. At the same time, Harold Haardrada, King of Norway, chose this moment himself to invade England. Harold defeated the Norwegians at Stamford Bridge near York and hurrying south with his weary army, now without the Northumbrians, met William on a hill near Hastings or Senlac where the English were routed and Harold killed. William immediately marched to London, forced the Saxon Witan to elect him king,

and had himself crowned at Westminster on Christmas day. The north, however, was still in the hands of the Saxons and for nearly six years William was forced to carry on a devastating war, but by 1072 he had subdued the country and even advanced to Scotland, over which he extended a purely nominal control. In England practically all the great Saxon landholders, whether they resisted William or not, were dispossessed in favor of his Normans.

William now turned his attention to consolidating his position in England and Normandy. He abolished the Saxon system of governing through great earldoms, practically counties palatine, contenting himself with only three such on the borders of England, Durham, Chester, and Kent (later suppressed). Breaking from the usual feudal custom, he then required an oath of allegiance to himself from all of his subjects holding land by noble tenure, whether they were his direct vassals or those of his tenants-in-chief. Aware that the power of the crown depended upon ample revenues, William introduced the developing Norman fiscal system and conducted a great survey of the financial resources of England, Domesday Book. The royal courts of his Saxon predecessors he left intact.

Although the Pope had hoped to profit by William's conquests of England by establishing papal authority more firmly over what had theretofore been a far-off and largely independent church, he found William, though a loyal son of the Church, by no means willing to sacrifice royal authority to the interests of the Holy See.

With the attempt to build a kingdom straddling the channel, which was for long to be a burden to its possessor, William himself was forced to deal. His son Robert raised a rebellion there and William was forced to suppress it with arms. His half-brother Odo, Bishop of Bayeux, for a time Duke of Kent, was another thorn to the king. In 1082 William was forced to imprison Odo to prevent a revolt being arranged by the latter. In 1087 another rebellion broke out in Normandy, this time supported by Philip I of France. Riding through Mantes, a French town which he had captured and burned, William's horse stumbled and threw the King. He died, almost abandoned by his supporters and family, at Rouen, Sept. 9, 1087, while his younger son, William, hurried to England to secure the throne. Another son, Henry, was likewise afterward King of England. Robert, William and Henry were sons of Mathilda, daughter of Baldwin V of Flanders, whom William married in 1053.

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WILLIAM II, surnamed RUFUS (c. 1056-1100), King of England 1087-1100, was born about 1056. He was the third and favorite son of William the Conqueror. In accordance with his father's dying request he was elected king and crowned Sept. 26, 1087. In 1088 a rebellion broke out in favor of his

older brother, Robert, Duke of Normandy. This revolt was put down in 1090 and in revenge William immediately invaded Normandy and forced Robert to accept a disadvantageous peace in 1091. In the same year he compelled Malcolm III of Scotland to pay homage. When he invaded Normandy a second time in 1094 he was forced to retire before the combined armies of Robert and Philip of France. Robert joined the First Crusade in 1096 and pledged Normandy to William for 10,000 marks. William was killed, perhaps accidentally, by an arrow while hunting in the New Forest, Aug. 2, 1100.

WILLIAM III (1650-1702), King of England, Scotland and Ireland, was born at The Hague, Nov. 4, 1650, posthumous son of William II of Nassau, stadtholder of Holland, and of Mary, daughter of Charles I of England. He was popular with his Netherlands subjects, and in 1672 they restored the office of stadtholder in his favor. When Louis XIV invaded the United Provinces William succeeded in forming a coalition against him and ably directed his country's defense, ultimately opening the dykes below Amsterdam and letting in the sea to force the French to retire. Following the Peace of Nimwegen (1678), Louis continued his aggressions as if war were still on, annexing lands in Lorraine and Alsace and invading the Spanish Netherlands. Alarmed and determined to protect his country from another invasion by Louis XIV, William organized the Grand Alliance by getting England and Holland to unite with the league in 1689.

The year before (1688) the revolution, which drove James II from the throne, occurred in England. William's wife, Mary, was the oldest daughter of James and therefore the rightful successor. Her supporters, especially the Protestants who had feared the Catholic leanings of James, invited William and Mary to the throne. They accepted and William appeared with 500 ships at Torbay on Nov. 5, 1688. Seeing his cause hopeless, James threw the Great Seal in the Thames and fled to France where Louis gave him a pension. In the meantime, William entered London and on Feb. 13, 1689 Parliament offered the Crown to William and Mary jointly. The offer was conditioned on the acceptance by William of the Declaration of Rights (1689), later in the year enacted into the Bill of Rights, by which "the liberty of the subject and the power of Parliament were finally secured against the power of the Crown." William subscribed to both in good faith and at no time during his reign did he seek to regain the rights he signed away. "He preserved the compact." Nevertheless he wielded much power by playing off the Whigs against the Tories.

The year after his succession, James appeared in Ireland and with a large army threatened English authority. On July 1, 1790, William met him with a somewhat larger force and decisively defeated him in the Battle of the Boyne. Though less successful in the war against Louis XIV on the Continent, he forced the French King formally to acknowledge him

as king of England and recognized the Protestant Succession as provided by the terms of the Treaty of Ryswick in 1697. Mary had died in 1694, but William continued to reign as sole ruler till his death at Kensington, Mar. 8, 1702.

WILLIAM IV (1765-1837), King of England, was the third son of George III, was born in Buckingham Palace, London, Aug. 21, 1765. He was trained in the British navy and promoted until he attained the rank of Lord High Admiral. In 1818, the future king married Princess Adelaide of Saxe-Meiningen and had two daughters, both of whom died in infancy. In 1830, William as "sailor king" succeeded George IV. By his easygoing manners he acquired popularity. During his reign was passed the great Reform Bill of 1832 which created the modern House of Commons. At his death on June 20, 1837, he was succeeded by his niece, VICTORIA.

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WILLIAM I (1797-1888), German Emperor and King of Prussia, the second son of Frederick William III of Prussia and Louise of Mecklenburg-Strelitz, was born at Berlin on Mar. 22, 1797. He studied from 1806 to 1809 at Königsberg and Memel, in 1807 getting his first commission. Appointed a captain in 1813, he took part in the campaign of 1814, and was given an Iron Cross for bravery in 1815. He became a colonel in 1817, a major-general the following year, and in 1820 a commander of division. After zealous study of the military systems of Prussia and other European nations for nine years, during which he was made a lieutenant-general, in 1829 he was married to Augusta of Saxe-Weimar, the mother of Frederick III.

In 1840, when Frederick William III died and the childless Frederick William IV mounted the throne, William became the heir presumptive to the throne of Prussia as well as vice-governor of Pomerania and a general in the army. The Revolution of 1848, in which William was credited with the sanguinary street scene in Berlin on March 18 (*see GERMANY: History*), caused him to be so unpopular that he went to reside in London. There he came to know intimately the prominent diplomats of the day in Europe. In 1849, after crushing an insurrection in Baden, he became the military governor of Westphalia, and in 1854 field-marshal and commandant at Mainz. He became king on Jan. 2, 1861.

His entire reign was dominated by his chief minister, Bismarck, who fortunately agreed with his sovereign in nearly all matters. The two agreed on two salient points—the divine right to kings and the necessity of a union of Germany—, and worked throughout the reign for them. The proclamation, issued on Jan. 18, 1871, making William Emperor of Germany was the result of the military union of all Germany against the ancient enemy, France.

After the Franco-Prussian War William I allowed Bismarck more and more authority in matters of imperial policy. Twice in 1878 his life was threat-

ened by assassins, the second murderer wounding him seriously. He died at Berlin on Mar. 9, 1888.

WILLIAM II (1859-), Emperor of Germany and King of Prussia, son of the Emperor Frederick III and Victoria, oldest daughter of Queen VICTORIA, was born Jan. 27, 1859. He suffered from childhood from a crippled arm. Great care was taken in his upbringing and early education, for the important rôle the heir to the imperial crown would be called upon to play. He attended the University of Cassel, served in the army and studied law at the University of Bonn. On the death of his father, after a brief reign of only three months, William succeeded to the throne in June, 1888. Young and energetic—he was only 29—he entered upon the life and activities of the sovereign with extraordinary, even embarrassing, enthusiasm. This soon brought him into conflict with the Chancellor, Prince BISMARCK, whom he practically forced to resign in 1890. Assuming the direction of affairs himself, and selecting chancellors more ready to follow his lead, the young emperor struck out on what is often called the New Course (Neue Kurs) in Germany's policy, which soon lost her the friendship of Russia and, ultimately that of England. Bismarck had not been out of office a year before the Kaiser, in a most tactless manner, refused to renew the Russian Re-insurance treaty, which the Chancellor considered extremely important. Entirely isolated, Russia turned to France, and entered into an alliance which became the basis for the Triple Entente later.

For 40 years William was the foremost monarch of Europe. Thoroughly imbued with the belief in the sanctity of his royal prerogative, he took an active part in every phase of the life of his time whenever his fancy dictated, and, being unusually versatile and imaginative, he often did so with real distinction. At times, however, it led him into serious mistakes, which, as in the case of the Kruger telegram, the Daily Telegraph interview, the brutal instructions to his brother Henry on the departure of the punitive expedition to China, his quarrel with the Prince of Wales, his blind, though loyal, support of a tottering Austria-Hungary in the crises of 1908, 1912 and 1914, not only seriously damaged the prestige of Germany, but led to the tightening of the alliances against her. On the other hand, he greatly furthered the intellectual and social life of Germany. He was enthusiastic in promoting the arts and sciences, education, social welfare and above all, the army and the navy. The navy in particular enlisted his support at the opening of the century. He sponsored the Navy League and on repeated occasions announced to the world that Germany's future lay on the sea. His unusual versatility suggested a rather superficial type of mind, which was further characterized by an almost morbid desire to play an important rôle on every occasion.

Much light, most of it of a hostile nature, has been thrown on William's character and policies by the embittered *Memoirs* of his mother and more recently by those of von Bülow. Never has a ruler's life and character been laid bare so relentlessly.

Very much sobered in the later years of his reign, and manifestly much concerned over the precariousness of Germany's position through the weakness of the Triple Alliance on the one hand, and the growing strength of the Triple Entente on the other, he abandoned his former methods. The question as to his responsibility for the World War, which was written into the Treaty of Versailles, has become a subject of bitter debate. During the war he did not play a very important part, the heavy task falling on other shoulders. Upon the outbreak of the revolution in Germany, following the defeat of the German armies on the west front, he escaped to Holland and abdicated, Nov. 28, 1918. There he has lived in retirement at the little village of Doorn, the allies willingly acceding to the refusal of the Netherlands for his extradition and trial.

W. E. LI.

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WILLIAM I, THE SILENT, Count of Nassau and Prince of Orange (1533-84), was born in the castle of Dillenburg at Nassau on Apr. 16, 1533. In youth he was a favored page of Emperor Charles V, and gained further favor under the Emperor, receiving the command of the army of the Netherlands at 22 years of age. He inherited the Orange Principality in 1544, was appointed governor of Holland, Zealand and Utrecht in 1555, and served with the army of Philip II against Henry II of France. He negotiated the treaty of Chateau-Cambresis in 1559. In the same year he succeeded his father as Count of Nassau. Although educated in Catholicism, William resisted Spain's efforts to force the Roman faith on the Dutch, refused to appear before Alva's Council of Blood, and declared himself a Protestant. Powerless to resist Philip's armies, he issued letters of marque to Dutch seamen, the "Beggars of the Sea," and gradually made serious inroads on the Spanish position by capturing Brielle and other places. In the meantime William, redoubling his efforts, brought about the PACIFICATION OF GHENT in 1576, followed in 1579 by the Union of Utrecht between the seven northern provinces. Two years later the seven provinces declared their independence from Spain and settled the stadthaltership on William and his heirs. In this manner William became the founder of the Republic of the United Provinces. Philip II having offered a large reward for the extermination of such a dangerous enemy, William the Silent was assassinated at Delft, Holland, by Balthazar Gerard on July 10, 1584.

WILLIAM AND MARY, COLLEGE OF, a co-educational, state controlled institution at Williamsburg, Va. It was established through the efforts of the Rev. Dr. James Blair, who secured the support in England of King William and Queen Mary, after whom the college was named. The college was chartered in 1693 and is the second oldest in the United States. Washington used the college as a hospital

during the Yorktown campaign, and during the Civil War it again saw military service, being used by officers of the United States Army. The grounds and buildings were valued in 1931 at \$5,500,000. The library of 76,000 volumes contains the Claiborne Collection of Virginia. In 1931-32 there were 1,610 students enrolled, and a faculty of 75, headed by Pres. JULIAN A. C. CHANDLER.

WILLIAM JEWELL COLLEGE, at Liberty, Mo., a coeducational institution founded in 1849, is controlled by the Missouri Baptist General Association. It had productive funds in 1931 amounting to \$1,196,090. Carnegie Library of 36,000 volumes contains the private library of Charles Haddon Spurgeon. In 1931-32 there were 424 students and a faculty of 25, headed by Pres. John F. Herget.

WILLIAM OF LORRIS. See GUILLAUME DE LORRIS.

WILLIAM OF MALMESBURY (c. 1095-c. 1142), English historian, monk and librarian of the monastery at Malmesbury, probably born in Somersetshire about 1095. Educated at the monastery at Malmesbury, he later refused to be its abbot. His works include *De Gestis Regum Anglorum*, "History of the English Kings" from the Saxon invasion to 1128; *Historia Novella*, a "Modern History," a continuation of *De Gestis*; *De Gestis Pontificum Anglorum*, "History of the Prelates of England" from St. Augustine's conversion of Ethelbert of Kent to the year 1123; accounts of the lives of St. Patrick, St. Dunstan, and St. Wulfstan and several books of miracles. He died at Malmesbury about 1142.

WILLIAM OF NEWBURG (c. 1136-c. 1198), English monk and historian, was born in Yorkshire. At an early age he entered the Augustinian priory at Newburg, where he spent the rest of his uneventful life. At an advanced age some illness or deformity caused him to give up his ordinary monastic duties, and in 1196, at the request of a neighboring abbot, he began writing his *Historia rerum Anglicarum*. Beginning in 1066, the history breaks off abruptly in 1198. Although written rapidly, it gives evidence of long and careful preparation. William was sometimes uncertain in his facts, and his chronology is frequently faulty. He made use of Henry of Huntingdon and other earlier writers, but does not seem to have used William of Malmesbury. The intimate relations of his priory with the powerful and widespread Cistercian Order gave him access to much information on contemporary affairs. In critical ability he ranks high; Freeman called him the father of historical criticism. He had no use for the romancing of Geoffrey of Monmouth. William was not a mere chronicler of facts, but a discriminating judge of what was significant. His history is one of the principal sources for the reign of Henry II.

WILLIAM OF TYRE (c. 1130-c. 1190), historian, was born in the Kingdom of Jerusalem. Educated in Europe he became active in the affairs of the crusader state from about 1165. He was sent on diplomatic missions to Rome and Constantinople and acted as tutor

for the young prince who became Baldwin IV. He was appointed by the latter chancellor of the Latin Kingdom in 1174, and archbishop of Tyre in 1175. He attended the Third Lateran Council in 1179. In the years immediately prior to Saladin's conquest of the Latin Kingdom he is said to have been in western Europe soliciting aid for the crusaders. There is a story of some uncertainty that he was poisoned by the Patriarch. He is one of the distinguished medieval historians by reason of his *Historia Hierosolymitana* in 23 books, which recounts the story of the Latin Kingdom from the beginning until 1184, a work undertaken about 1169 at the suggestion of King Amalric I. Modern scholars formerly made the error of accepting his story of the FIRST CRUSADE but it is now clear that for the early period his work is unoriginal and of no value. For the period after 1144 it offers a useful chronicle with considerable varied information.

WILLIAMS, SIR GEORGE (1821-1905), British merchant, publicist, and founder of the Young Men's Christian Association, was born at Dulverton, Somerset, in 1821. Beginning work with a London dry-goods firm in 1841, he soon persuaded some of his fellow clerks to join him in a regular series of prayer meetings. By 1844 twelve of the employees had formed a society called the Young Men's Christian Association, of which Williams was prime organizer. He was treasurer, 1863-85, and from then on president of the association. In 1894 he was knighted, having meanwhile become head of the firm which he had entered as a clerk. His London house in Russell Square was given to the Y.M.C.A. as headquarters. He died in London, Nov. 6, 1905.

WILLIAMS, JESSE LYNCH (1871-1929), American author, was born at Sterling, Ill., Aug. 17, 1871, and graduated at Princeton University in 1892. His first volume, *Princeton Stories*, 1895, was followed by *History of Princeton University*, written with John De Witt and published in 1898. Williams wrote many short stories, novels and plays, his comedy, *Why Marry?* winning the Pulitzer Prize in 1927. Among his other plays are *The Stolen Story* and *Lovely Lady*. Williams died Sept. 14, 1929.

WILLIAMS, ROGER (c. 1604-84), founder of Rhode Island, was born in Wales some time between 1599-1604. He was educated at the Charter House School, London, and at Pembroke College, Cambridge, received ordination, and adopted the views of the Puritans. He arrived in Massachusetts in 1631, and became assistant pastor at Salem. Denying the right of magistrates to penalize sabbath-breaking, he fled from intolerance to the Plymouth colony, where in Aug. 1631, he became assistant pastor. Two years later he returned to Salem, only to meet trouble again on account of his contention that the land belonged to the Indians and not to Charles I. In 1635 he was ordered to quit the colony, but escaped to friendly Indians, who gave him in 1636 a tract of land which became the site of the city of Providence. His influence with the Indians enabled him to save

New England from an Indian war in 1645. In 1643 he journeyed to England and obtained the charter for Rhode Island and the Providence settlement. When he was in England in 1651-54 he saw much of Cromwell and Milton. Upon his return to Providence he became president of the colony, a post which he held until 1658. His controversies with John Cotton over religious toleration revealed not only his tolerant spirit but also his logical reasoning. Although he had little respect for the views of those who differed from him, he consistently refused to countenance the persecution of anyone because of religious belief or practice. He died in Rhode Island, probably at Providence, in the spring of 1684.

WILLIAMS, SAMUEL WELLS (1812-84), American missionary, diplomat and writer, born at Utica, N.Y., Sept. 22, 1812. In 1833 he went as a missionary of the American Board of Commissioners for Foreign Missions to Canton, and immediately after his arrival began the study of the Chinese language, literature and history which made him in due course one of the leading Sinologists. He served as interpreter with Commodore Perry, when the latter was on the expedition which resulted in the opening of Japan in 1853. Four years later he resigned from his missionary work, and became interpreter at the American Legation in Peking, which post he continued to hold until 1876, when he returned to the United States, to become professor of Chinese language and literature at Yale University. His several books, particularly *The Middle Kingdom*, are among the most authoritative on conditions in China during his stay there. He aided very materially, through his understanding of Chinese life, in establishing the friendly feeling of the Chinese toward Americans. He died at New Haven, Conn., Feb. 16, 1884.

WILLIAMS, WALTER (1864-), American educator, was born in Boonville, Mo., July 2, 1864. After a high school education he became a printer and subsequently became editor and owner of various newspapers in Missouri. In 1908 he became dean of the school of journalism and professor of history and principles of journalism at the University of Missouri, and in 1930 he was elected president of the university. His many publications include *The Practice of Journalism* and several histories of Missouri.

WILLIAMSBURG, a town of historic interest in southeastern Virginia, the county seat of James City Co. It is situated between the James and the York rivers, 48 mi. southeast of Richmond and is served by bus lines and two railroads. Settled in 1632 and the oldest incorporated town in Virginia, Williamsburg contains many buildings dating from Colonial days. The Bruton Parish Church, erected in 1678, has been restored. A restoration organization, which has received funds from JOHN D. ROCKEFELLER, JR., has acquired about 90% of the property comprising the old colonial town. The buildings of modern construction are being torn down and replaced by restorations of the early homes. Williamsburg is the seat of WILLIAM AND MARY COLLEGE, founded in 1693. From 1698

until the Revolution Williamsburg was the seat of government. Pop. 1920, 2,462; 1930, 3,778.

WILLIAMSBURG, BATTLE OF, May 5, 1862, a chance engagement of the CIVIL WAR, between several regiments of the Confederate army under Generals Magruder and Johnston and the vanguard of Gen. McClellan's Union army. Having discovered that Magruder's army was retreating from Yorktown toward Richmond, McClellan gave pursuit. His advance regiments unexpectedly encountered resistance at Williamsburg, Va. Gen. Longstreet, commanding the Confederate force, maintained his ground throughout the day against the inferior Federal force under Gen. Hooker, inflicting 2,000 casualties against Confederate losses of 1,500. The technical advantage of the Confederates in this battle was insufficient cause for checking the retreat; and Johnston's army proceeded toward Richmond.

WILLIAMS COLLEGE, Williamstown, Mass., a college for men chartered in 1793 under a bequest of money by Col. Ephraim Williams. It has departments in astronomy, biology, chemistry, languages, geology, history, mathematics, philosophy, physics, political science and religion. The university had an endowment fund in 1931 of \$7,610,986. The library contains 133,000 volumes. There were 808 students in 1931 and 84 teachers, headed by Pres. HARRY A. GARFIELD.

WILLIAMSON, a city and county seat of Mingo Co., southwestern West Virginia, situated on the Tug River, 107 mi. southwest of Charleston by highway. It is served by the Norfolk & Western Railroad and bus lines. The city is a trade and supply center for an important bituminous coal region; mining is the chief industrial interest. In 1920-21 serious disputes between the mine owners and the labor agitators reached the point of civic disorder. Williamson was founded in 1893 and incorporated in 1895. Pop. 1920, 6,819; 1930, 9,410.

WILLIAMSONIA, a prolific and widely distributed genus of Mesozoic fossil cycads (*see* CYCADOPHYTES) which bore showy flowers sometimes 5 in. in diameter, and stalked fruits outwardly resembling a globe artichoke. Recent study of supposedly female cones of these plants having revealed peculiar shoulders indicating where stamens dropped away as the seeds matured, the flowers are now held to be largely bisexual as in the allied BENNETTITES. Williamsonias are taller and less stumpy than the earlier genus Bennettites. In *W. gigas* of the Yorkshire coast, found with fronds and flowering shoots attached to the stem, a slender columnar shaft, scarred by rhomboidal leafbases, was crowned by spreading, fernlike leaves 2 ft. or more in length.

WILLIAMSPORT, a city and county seat of Lycoming Co., Pa., on the Susquehanna River about 90 mi. northwest of Harrisburg. It is served by the New York Central, the Pennsylvania and the Reading, the Susquehanna and New York railways, motor buses and a nearby airport. A tourist resort and manufacturing city, formerly largely timber-producing, Wil-

liamSPORT is also in an agricultural region midway between Pennsylvania's anthracite and bituminous centers. In 1929 manufactures, chiefly motors and rubber, leather, silk and wire rope, steel and wood products, clothing, and musical instruments, were valued approximately at \$62,000,000; the retail trade amounted to \$25,892,538. The town is accessible to many interesting resorts, trails and natural phenomena, and is on the Susquehanna Trail. In the early history of America, Indian massacres occurred on ground now occupied by Williamsport, and on June 10, 1778 many of the settlers were killed by the savages. The city was founded by Michael Ross in 1796, it became a borough in 1806 and a city 60 years later. It is the seat of Dickinson Seminary, a junior college, and has several parks. Pop. 1920, 36,198; 1930, 45,729.

WILLIAMSTOWN, a town and village in Berkshire Co., northwestern Massachusetts. The village is situated between the Hoosic and the Green rivers, in the heart of the Berkshire hills near the foot of Greylock mountain. It is five mi. northwest of North Adams, and served by motor buses, and the Boston and Maine Railroad. The town has a few cotton mills. The center of the village is occupied by the beautiful campus of Williams College, founded by Col. Ephraim Williams, opened in 1793. The older college buildings and some fine new edifices including the chapel, auditorium and library, also a number of handsome fraternity houses and private residences facing streets lined with elms give unusual charm to the place. The Institute of Politics, founded in 1921 by Harry A. Garfield, president of Williams College, is held here every summer. Haystack monument in Mission Park marks the founding of the first foreign missionary society in the United States. Near the village of South Williamstown is a model experimental farm owned by E. Parmalee Prentice. The town was incorporated in 1765. Pop. 1920, 3,707; 1930, 3,900.

WILLIAM TELL, an opera in five acts by G. A. ROSSINI, libretto by "Jouy" (V. J. Étienne) and Hippolyte Bis; première, Paris, 1829, London, 1830, New Orleans, 1842. The original five acts were cut down to three, and later expanded to four. It is Rossini's last and, in some respects, best opera.

In order to save his daughter from dishonor, Leutholf has killed a soldier in the employ of the governor, Gessler. To escape punishment he takes flight in a boat, and is assisted by William Tell, who thus incurs the enmity of the governor. Mathilde, Gessler's ward, is loved by Arnold, who is torn between his loyalty to Switzerland and his devotion to a girl with Austrian sympathies; however, when he hears that his father has been slain by the Austrian forces, he forgets everything but devotion to his own people. Meanwhile Gessler has omitted nothing to humiliate the Swiss, placing his hat on a pole in the Altdorf marketplace and commanding that all who pass it shall bow. William Tell and his son both defy the order, and in consequence the father is ordered to shoot an apple from the son's head with a bow and arrow. The shot, much to the governor's surprise, is successful. Tell is

imprisoned, but a new Swiss uprising proves successful. Tell slays the tyrannical Gessler, and Mathilde, renouncing her fatherland, flies into the waiting arms of the Swiss Arnold.

WILLIBRORD or **WILLEBROD**, ST. (c. 657-738), an English missionary, apostle to the Frisians, born in Northumberland about 657. He was brought up in a monastery at Ripon, near York, and later studied in Ireland where he remained to preach. In 690 he sailed for Friesland as a missionary. He was very successful, converting many and founding a number of religious houses and churches. Pope Sergius I consecrated him bishop, and in 695 he was made archbishop of Utrecht. Pepin of Herstal and Charles Martel were friendly to him, and St. Boniface worked with him for three years. He died in 738 and was buried in the monastery of Echternach, which he founded, near Trier. It is said that miracles have been performed at his tomb.

WILLIMANTIC, a city in Windham Co., in eastern Connecticut, situated 25 mi. east of Hartford, at the place where the Natchaug and Willimantic rivers meet. Bus lines and two railroads serve the city, which is within the township of Windham. The region is fine farming country. The principal manufactures of the city are cotton thread and silk. In 1929 the value of the factory output was about \$14,000,000; the retail trade amounted to \$7,618,879. The first silk mill in America was built six mi. from here in 1810. Willimantic was settled in 1822, made a borough in 1833, and the city incorporated in 1895. The city is an educational center, having a high school, State Normal School, State Training School and State Trade School. Pop. 1920, 12,330; 1930, 12,102.

WILLINGDON, THOMAS, EARL OF (1866-), viceroy of India, was born Sept. 12, 1866, of an old Sussex family. He was educated at Eton and Cambridge. He was aide-de-camp to Lord Brassey, when the latter was governor of Victoria, 1891-1900; was a member of Parliament, 1900-10, and junior lord of the treasury, 1905-12. He served as governor of Bombay, 1913-19; of Madras, 1919-24, and was one of the delegates for India at the Assembly of the League of Nations, 1924. In 1926-31 he was governor-general of Canada, becoming viceroy of India in 1931. He was created first Baron of Raton in 1910, first Viscount of Willingdon in 1924, and first Earl of Willingdon in 1931.

WILLIS, NATHANIEL P. (1806-67), American writer, was born at Portland, Me., Jan. 20, 1806. He was graduated from Yale, edited two annuals in Boston, and in 1829 established there *The American Monthly Magazine*. This was later merged with the New York *Mirror*, Willis remaining as associate editor. In 1846 he founded *The Home Journal* and edited it until his death. He was perhaps the foremost journalist of his time. Among his books are *Loiterings of Travel* and *People I Have Met*. He died at Cornwall-on-Hudson, N.Y., Jan. 20, 1867.

WILLISTON, SAMUEL WENDELL (1852-1918), American paleontologist and entomologist, was

born at Boston, Mass., July 10, 1852. In 1872 he took his B.S. from Kansas Agricultural College. While supporting himself by surveying he devoted his spare hours to the study of medicine and to collecting vertebrate fossils. In 1876 he was made aide to Dr. O. C. Marsh, professor of paleontology at Yale, where Williston also worked independently. He took his medical degree in 1880, his doctorate in philosophy five years later and was made professor of anatomy at Yale in 1886. Appointed in 1890 professor of geology at the University of Kansas, he served until 1902, leaving to take the chair of vertebrate paleontology at the University of Chicago. Particularly noteworthy are his authoritative *Manual of North American Diptera*, *Osteology of Reptiles*, *American Permian Vertebrates*, *Water Reptiles of the Past and Present*, and other studies of vertebrate paleontology. He died at Chicago, Ill., Aug. 18, 1918.

WILLISTON, a city in northwestern North Dakota, the county seat of Williams Co., situated on the Missouri River, near the Bad Lands. Served by the Great Northern Railroad, the city ships wheat, livestock and coal. Williston was founded in 1880. Pop. 1920, 4,178; 1930, 5,106.

WILLMAR, a city in central Minnesota, the county seat of Kandiyohi Co., situated 102 mi. northwest of St. Paul. The Great Northern Railroad serves the city. The countryside is agricultural, dotted with beautiful lakes. Machine shops, a foundry and a sash and door factory afford the chief industrial activities. The city is also a wholesale trade center, and the seat of the State Hospital for the Insane. Willmar was settled in 1869 and incorporated in 1874. Pop. 1920, 5,892; 1930, 6,173.

WILL-O'-THE-WISP, the *ignis fatuus*, an elusive phosphorescent light that dances and flickers over certain kinds of marshy ground and, it is said, over churchyards. It is known also as Jack-o'-Lantern, the Friar's Lantern, and as ROBIN GOODFELLOW.

WILLOW, the common name for a large genus (*Salix*) of woody plants constituting with the poplars and aspens the willow family (*Salicaceæ*). There are about 170 species found mostly in the north temperate and arctic regions, a few extending to the Southern Hemisphere, none occurring in Australia or New Zealand. Fully 70 species are found in North America, of which about 25 attain the size of trees. They are mostly trees or shrubs with thin, abundant sap, scaly bark, light, soft wood and slender, tough, round branchlets which often break off easily at the joints. Willows usually bear narrow, lance-shaped, pointed leaves and small, mostly greenish flowers in dense clusters called aments or catkins, the male and female flowers being borne on separate trees. The fruit, an oblong pointed capsule, splits open when ripe into two recurved valves releasing numerous minute, downy, tufted seeds.

The white willow (*S. alba*) and the brittle willow (*S. fragilis*), both naturalized in the eastern states, are important European timber trees, and the wood of various other willows is utilized for numerous

purposes. Since Roman times the tough flexible branches of various willows known as osiers have been used in making baskets. The bark, rich in tannic acid, is employed in tanning leather and contains



WHITE WILLOW

(*Salix alba*). Male catkin and flower (above). Female catkin and flower (below)

salicin, a bitter glucoside used in medicine. Various willows are grown as ornamentals, for quick shade, wind-protection and as binders to prevent soil erosion by streams.

Besides the white willow and the brittle willow the Old World species most commonly planted and more or less naturalized in the United States include the purple OSIER (*S. purpurea*), the osier or basket willow (*S. viminalis*), the sallow or goat willow (*S. Caprea*), the laurel-leaved willow (*S. pentandra*), the yellow willow (*S. vitellina*) and the weeping willow (*S. babylonica*).

Of the native North American species the most common is the black willow (*S. nigra*), found across the continent; other well known species are the PUSSY WILLOW (*S. discolor*), the peach willow (*S. amygdaloides*), the shining willow (*S. lucida*) and the sandbar willow (*S. longifolia*), of the eastern states, and the red willow (*S. laevigata*), the western yellow willow (*S. lasiandra*) and the arroyo willow (*S. lasiolepis*), of the Pacific slope. A. B. J.

WILLOW HERB, the common name for a numerous genus (*Epilobium*) of herbs and small shrubs of the evening primrose family. There are probably 200 species, native chiefly to north temperate regions, some 60 of which occur in North America. They are mostly erect herbs bearing opposite leaves, rose-purple to white flowers, with their parts in fours, and long, narrow, four-sided fruiting capsules containing numerous tufted seeds. Representative species are the great willow herb or FIREWEED (*E. angustifolium*) and the hairy willow herb (*E. hirsutum*), with handsome purple flowers, native to the Old World and naturalized in eastern North America.

WILLOWS, a town in northwestern California, the county seat of Glenn Co. It is situated about 80 mi. northwest of Sacramento in the midst of an irrigated region. The leading interests are sheep raising and

the growing of barley, rice, fruits and nuts. The town has cheese and butter factories and a fine Memorial Hall. Pop. 1920, 2,190; 1930, 2,024.

WILLS, HELEN NEWINGTON. See MOODY, HELEN NEWINGTON WILLS.

WILMERDING, a borough of southwestern Pennsylvania, in Allegheny Co., situated on the Pennsylvania railroad 14 mi. southeast of Pittsburgh. Primarily an industrial community, Wilmerding manufactures air brakes and machine shop products. Coal mines are nearby. Pop. 1920, 6,441; 1930, 6,291.

WILMETTE, a residential suburb of Cook Co., northeastern Illinois, situated on Lake Michigan, 14 mi. north of Chicago. An electric and an elevated line and the Chicago and North Western and the Chicago North Shore railroads afford transportation. The retail trade in 1929 amounted to \$5,508,147. Wilmette is primarily a community of homes, with a fine beach and a harbor suited to aquatic sports. In the vicinity are forest preserves. Antoine Ouilmette built here the first home of logs, in 1826-29. In 1869 the site was plotted, and in 1872 the village was incorporated. Pop. 1920, 7,814; 1930, 15,233.

WILMINGTON, a port city in northern Delaware, the county seat of New Castle Co. It is situated at the meeting of the Delaware, the Christiana and the Brandywine rivers, 24 mi. southwest of Philadelphia. Bus and truck lines, airplanes, steamships and three railroads serve the city. In 1929 its factory output was worth about \$89,000,000; the retail trade amounted to \$65,149,147 in the same year. The chief products include leather, vulcanized fiber and printed matter. The wholesale trade proper in 1929 was worth \$19,001,257. The municipal marine terminal was completed in 1923. The commerce of the harbor was valued at \$72,566,673 in 1929. Wilmington is the trading center for a rich agricultural region which produces chiefly corn, wheat, hay, fruit and vegetables. Among the city's interesting landmarks are Old Swede Rock, where the first white settlers landed, and Old Swedes Church, erected in 1698 and still used as a place of worship. Educational institutions in Wilmington include the Friends' school, Tower Hill School; the University of Delaware is at Newark, about 13 mi. distant. The site of Wilmington was founded about 1638 by Swedish and Dutch settlers. The city was chartered in 1832. Pop. 1920, 110,168; 1930, 106,597.

WILMINGTON, the most important port city of North Carolina, and the county seat of New Hanover Co. It is situated in the southeastern part of the state, on Cape Fear River and on the Federal Intra-coastal Canal. Steamship lines, bus lines, and three railroads serve the city. The Bleuthenthal Airport is located 2 mi. from Wilmington. There is an adequate freshwater harbor. Truck products are the chief crops of the region. The principal manufactures are fertilizers and petroleum and lumber products. In 1929 the value of the factory output was about \$6,000,000; the retail trade amounted to \$15,679,283. Shipping is an important industry.

Wilmington was founded by the English in 1730. It was in this city, eight years before the Boston Tea Party, that the Stamp Act was first resisted. Lord Cornwallis made his headquarters here during the American Revolution. All during the Civil War Wilmington carried on foreign trade and supplied the Confederate Army with necessities. The naval Battle of Fort Fisher brought the port into the hands of the Federal Government. William Hooper, signer of the Declaration of Independence, was born here. President Woodrow Wilson and James Cardinal Gibbons once lived here. Pop. 1920, 33,372; 1930, 32,270.

WILMINGTON, a city in Clinton Co., southwestern Ohio, situated 52 mi. northeast of Cincinnati. It is served by two railroads. Pure bred hogs and cattle are raised in this region. The city has many manufactures, including bridges, auger bits, gray iron castings, harvesting appliances and furnaces. It is the seat of Wilmington College. John Bryan State Park is a few miles north. Pop. 1920, 5,037; 1930, 5,332.

WILMOT, DAVID (1814-1868), American political leader, was born in Bethany, Pa., Jan. 20, 1814. He studied law and in 1834 began to practice at Towanda, Pa., where he became a prominent lawyer and democrat. In 1845-51 he was a member of Congress and in 1846 introduced the WILMOT PROVISIO. In June 1862 the principle of this Proviso was embodied in the act prohibiting slavery in all existing and acquired territory. Wilmot served in the senate as a Republican in 1861-63 and later was judge of the U.S. Court of Claims until his death in Towanda, Pa., Mar. 16, 1868.

WILMOT PROVISIO, a provision attached to Congressional appropriation bills of Aug. 1846, and Feb. 1847, designed to exclude slavery from the domain acquired by the United States in the MEXICAN WAR. When the House of Representatives was considering a bill appropriating money to be used in buying the Mexican claims to the disputed territory, David Wilmot, Democratic member from Pennsylvania, moved that "neither slavery nor involuntary servitude shall ever exist in that territory. . . ." When in the next session of Congress a similar bill was introduced, the first having failed, Wilmot again moved his proviso. In the House, which twice passed the proviso, and in the Senate, which rejected it, it was the subject of virulent debate which intensified the differences between the North and South. The principle of the Wilmot Proviso formed the basis, in part, of the FREE SOIL PARTY and later of the REPUBLICAN PARTY.

WILNO. See VILNA.

WILSA RIVER. See VISTULA.

WILSON, ALEXANDER (1766-1813), American ornithologist, was born in Paisley, Scotland, July 6, 1766. During his early years as a peddler, he wrote against the oppression of the weavers. After serving an imprisonment for libel, he came to America penniless and lived in Philadelphia. His project to collect and draw all the birds of the locality was fostered

by William Bartram, the naturalist, and after securing, in 1806, the editorship of *Ree's Encyclopedia*, Wilson was able to concentrate on his famous work, *American Ornithology*. Between 1808 and 1813, seven volumes were published. Wilson died in Philadelphia, Aug. 23, 1813, two volumes of his work being published posthumously.

WILSON, HARRY LEON (1867-), American author, was born at Oregon, Ill., May 1, 1867. He entered journalism and from 1896-1902 was editor of *Puck*, also in 1896 publishing his *Zig Zag Tales*. He is the author of many novels and plays. In collaboration with BOOTH TARKINGTON he wrote *The Man from Home*, which met with great success in 1908, as did the subsequent dramatization of the story. Other well-known novels by Wilson are *Bunker Bean*, 1912, *Merton of the Movies*, 1923, and *Lone Tree*, 1929.

WILSON, HENRY (1812-75), 18th Vice-President of the United States, was born at Farmington, N.H., Feb. 16, 1812, son of Winthrop Colbath. He had his name, Jeremiah Jones Colbath, legally changed to Henry Wilson in 1833. He became a shoe manufacturer, and in campaigning for William Henry Harrison in 1840, addressed more than 60 Whig meetings as the "Natick cobbler." Later he became famous as an anti-slavery orator. He was a member of the Massachusetts General Court, 1840-41, and of the Massachusetts Senate, 1843-45, and in 1850-52. Having purchased the *Boston Republican* in 1848, he made it the organ of the Free Soil Party. In 1852 he was chairman of the Free Soil National Convention.

Wilson later became active in the formation of the Republican Party. From 1855-73 he was in the United States Senate. As the Massachusetts colleague of Charles Sumner in the Senate he denounced the attack upon the latter by Preston Brooks of South Carolina as "a brutal, murderous, and cowardly assault." Brooks challenged Wilson to a duel, which Wilson declined. He continued, however, fearlessly to explain his anti-slavery views in the Senate. In Mar. 1861, he became chairman of the Senate military committee. In 1861 he raised and commanded a regiment of Massachusetts infantry in McClellan's army, and served for a short time on the latter's staff. Wilson was active in the reconstruction controversies, favoring a policy of kindness towards the whites in the seceded states and at the same time fully protecting the rights of the Negroes. In 1872 he received the Republican nomination for Vice-President on the ticket with Ulysses Grant, and was elected. He died in Washington, D.C., Nov. 22, 1875.

WILSON, JAMES (1742-98), American statesman and jurist, was born in Carskerdo, near St. Andrews, Scotland, Sept. 14, 1742. He attended the Universities of St. Andrews, Glasgow and Edinburgh. He emigrated to the United States in 1765 where he resided in New York City until 1766 when he moved to Philadelphia. He was a tutor for a few months in the College of Philadelphia (now the University of Pennsylvania), at the same time studying law. He was admitted to the bar in 1767 and practiced in

Reading and Carlisle, Pa., and for a while in Annapolis, Md., during Howe's occupation of Philadelphia.

Although Wilson had not originally favored the independence of the colonies he became a prominent figure in the Revolutionary movement. One of the signers of the Declaration of Independence, he was a member of the Continental Congress 1775, 1776, 1782, 1783, and 1785-87. He was chosen colonel of the Fourth Battalion of Associators in 1775 and during the REVOLUTIONARY WAR attained the rank of brigadier-general of State militia, participating as a colonel in the New Jersey campaign of 1776. He was also a member of the Board of War of the Continental Congress.

Wilson was advocate-general for the French government in America in 1779 and guided that country's legal relations to the Confederation. He settled in Philadelphia in 1778 and intermittently continued his law practice during the Revolution. He was prominent as a delegate from Pennsylvania to the Convention at Philadelphia which framed the Federal Constitution. He objected to equal state representation in the new government, but as a delegate to the Pennsylvania Ratifying Convention of 1788 he sturdily supported the Constitution, which was finally approved by the State. He was appointed one of the first five Associate Justices of the United States Supreme Court, 1789-98. He was the first professor of law in the College of Philadelphia in 1790 and in the University of Pennsylvania when they were united in 1791. He died in Edenton, N.C., Aug. 28, 1798.

WILSON, JOHN (1785-1854), Scottish author, who wrote under the name of "Christopher North," was born at Paisley, May 18, 1785, and educated at Oxford University. After losing the greater part of his fortune, he entered journalism, and for many years contributed voluminously to *Blackwood's Magazine*. In 1820 he was appointed Professor of Moral Philosophy at Edinburgh University. Wilson's most important work is the *Noctes Ambrosianae* in which a number of his famous contemporaries appear as sharers in the dialogues. He died in Edinburgh, Apr. 3, 1854.

WILSON, THOMAS WOODROW (1856-1924), 28th President of the United States, born at Staunton, Va., Dec. 28, 1856, son of Joseph Ruggles Wilson, distinguished Presbyterian minister and teacher, and Janet Woodrow, daughter of Thomas Woodrow, Scotch Presbyterian minister in England and Ohio. He was a grandson of James Wilson of County Down, Ulster, immigrant to the United States in 1807, manager of the anti-Federalist Philadelphia *Aurora* and owner of newspapers in Ohio and Pennsylvania. Thomas studied at Davidson College, in 1873-74, and at Princeton 1875-79. There he was an editor of the *Princetonian*, a distinguished essayist and debater, but as a student he ranked low in the first third of his class. His article, "Cabinet Government in the United States," written in his senior year but published after his graduation in the *International Review* for August, 1879, set forth his life-

long admiration for the English Cabinet Government and his wish to see it adopted in the United States. He attended the law school of the University of Virginia and was much influenced by the great law teacher, John B. Minor. In Dec. 1880, poor health caused him to leave the university and spend 18 months recuperating and studying privately.

In 1882 Wilson was admitted to the bar and began to practice law in Atlanta Ga. But he soon gave up law practice in order to study history and political science at Johns Hopkins University in September, 1883. He published, Jan. 24, 1885, his book, *Congressional Government*, and set a new style in scientific writing about the Federal Government by describing the ways in which it actually worked rather than merely its theoretical operation and functions. He argued again for Cabinet government in the United States, and his explanation of the committee system in Congress has not yet been surpassed in thoroughness or simplicity.

In June, 1885, he married Ellen Louise Axson of Savannah, Ga., and in September he went to Bryn Mawr College, Pennsylvania, as associate professor of history and political economy. In 1886, Johns Hopkins accepted his book as a doctoral dissertation, conferred the degree, and the next year made him special lecturer; in 1888, he became professor of history and political economy at Wesleyan University, Connecticut, and lectured throughout New England. The next year, he published *The State: Elements of Historical and Practical Politics*. Both books have been frequently reprinted and have had great influence. From 1890 to 1910, he was professor of jurisprudence and political economy (to 1895), of jurisprudence (to 1897) and of jurisprudence and politics (to 1910) at Princeton University. During this time he published *An Old Master* (1893), *George Washington* (1897), *A History of the American People* in five volumes (1902). His university lectures, public addresses and published essays were remarkable for clearness and brilliancy of style, striking analytical conclusions and keen, critical judgment. He was much influenced by Edmond Burke and Walter Bagehot, and admired, especially, Washington, Jefferson and Lincoln. From 1902 to 1910, he was the first layman president of Princeton, and he introduced the preceptorial system to improve student scholarship and attempted to democratize the Princeton club life and thereby antagonized many alumni. The trustees rejected his plan. This, his disagreement with the dean of the graduate school and his interest in politics made him welcome, in September, 1910, the Democratic nomination for Governor of New Jersey, and he resigned his office at Princeton.

After a vigorous and idealistic campaign, he was elected by a plurality of 49,000 though the Republicans had won by 82,000 in 1908; and he surprised both the machine Democrats, who had nominated him, and his liberal Democratic opponents by immediately assuming state leadership of his party and proceeding to carry out his campaign pledges. The

"bosses," intending to select an eminently respectable figurehead, had found a master. Under his guidance, the legislature enacted a Direct Primaries Law, a Corrupt Practice Act and an Employers' Liability Act, liberalized municipal government and passed anti-trust laws known collectively as the "Seven Sisters."

He was much talked of for the Presidency. Credit is due chiefly to William Jennings Bryan for Wilson's nomination at the Democratic National Convention in Baltimore in July, 1912. Wilson was elected President by the extraordinary electoral majority of 435 votes to 88 for Roosevelt and 8 for Taft, but had a million less popular votes than his two opponents together. The Republican division elected him.

To Wilson, the President was the leader of his party, and responsible, with it, to the people for the conduct of the Government, and he acted accordingly throughout his administrations. Believing his election a mandate to liberalize the National Administration, he called Congress into extra session and, returning to the practice of Washington and Adams, appeared in person to deliver to the two Houses in joint session his message calling for immediate downward revision of the tariff. The opposition turned from their attack upon the President's attempt to introduce golden-rule diplomacy into our foreign affairs and concentrated their fire against this new "dictation from the White House," but his vigorous personal guidance of legislation was to be expected from his writings and his record as Governor. On May 26, 1913, he made an attack upon the tariff lobby and declared, "Only public opinion can check and destroy it!" The Underwood-Simmons Tariff Act, signed on October 3, 1913, put on the free list many raw materials and necessities, substituted *ad valorem* for specific duties; reduced the average rate from about 42% to about 26%, created a tariff commission to study the tariff scientifically and established an income tax. The President urged legislation to produce an elastic currency, and, on December 23, 1913, signed the Federal Reserve Act, designed to regulate banking and currency through a Federal Reserve Board appointed by the President. The Federal Trade Commission Act, preventing unfair competition in interstate trade, and the Clayton Anti-trust Act, forbidding price fixing and interlocking directorates, limiting injunctions and legalizing strikes, boycotts, and labor associations and declaring labor not a commodity, were debated and enacted during the winter and spring of 1913-14. Congress refused to give the Interstate Commerce Commission control over the issue of railway securities, but carried out all other important recommendations.

Assurances of ultimate independence were given the Filipinos, pressure was put on California to moderate anti-Japanese measures, "dollar diplomacy" was repudiated, the rights of other nations were conceded to the limit, and it was emphasized that the Federal Government would not use its power to increase unduly the gains of its citizens in foreign commerce. The Panama Canal toll exemptions for United States

ships were repealed, but the Senate refused to ratify a treaty apologizing to Colombia and paying her \$25,000,000 for our part in the separation of Panama. A virtual protectorate was assumed over Haiti by treaty in 1915, and practically a military government was established over Santo Domingo in 1916. The patient and tolerant policy pursued toward Mexico, the acceptance of the mediation of Argentina, Brazil and Chile in the Vera Cruz incident, the final recognition by the United States and eight South and Central American States of the Carranza Government in 1915 and the emphasis on "watchful waiting" did much, in spite of the aggressive policies in Haiti and Santo Domingo, to convince the Latin-American countries that the United States would not take advantage of a weaker neighbor for selfish benefit.

Upon the outbreak of the World War in 1914, President Wilson proclaimed the neutrality of the United States on August 4th, and on August 5th offered to mediate under The Hague Convention. The next day Mrs. Wilson died, and this lonely, shy, heavily burdened man lost the one friend to whom he had confided every thought for half a lifetime. For weary months he guided the nation through a most difficult neutrality, protesting vigorously against the interference with American shipping by the British in their efforts to stop indirect importations to Germany of war supplies, and calling Germany to account for violation of International Law in her submarine warfare and attempted blockade of the British Isles. Then came his campaign for reelection, and he was voted for by some because they thought he had vigorously upheld our rights, and by others because he had "kept us out of war." He himself said he had been elected in 1912 by default and in 1916 by accident.

The second administration was largely absorbed in the War and the Peace Conference. Diplomatic relations were broken off with Germany in February, 1917, and war was declared in April. The President had urged, in 1915, measures of military and naval preparedness, but his party was much divided on preparedness and comparatively little had been done to make ready for possible or probable war. Now the President followed the advice of the General Staff by having the Draft Act passed, by appointing their nominee, General Pershing, to command the American Expeditionary Force and by supporting him to the limit (*see* MILITARY POLICY). The Nation surprised itself and the world by the ultimate effectiveness of its making war, and was a decisive factor in the turn of the tide within a year and a half.

One of the most important influences in deciding the Germans and their Allies not to prolong the war, but to negotiate for peace, was the principle of making the world safe for all peoples, underlying the Fourteen Points set forth by President Wilson as the basis of an enduring peace. In spite of all his efforts at the Peace Conference, the terms forced upon Germany were much more severe than he fa-

vored, but he did succeed in having provision for a League of Nations inserted in the Treaty of Versailles. Due to his failure to take in his delegation to Paris any outstanding Republican, to the general misunderstanding of his appeal in 1918 for a Democratic Congress to help him finish up the business in hand and to many other factors in our chaotic and emotional reactions to domestic and international problems, the Treaty was never fairly considered on its merits and was so amended in the Senate that Wilson and his closest followers defeated it. He had collapsed in a serious physical and nervous breakdown in September 1919, while touring the United States in support of the League. The administration was haltingly conducted in his name during the rest of his term, for he was hardly in condition to take any active part, and no one felt authorized or able to act fully or vigorously for him. The voters seemed to repudiate in the election of 1920, at least his last favorite project, the League, and Wilson retired to private life in Washington as a prophet partly discredited with the people for whom and for whose world leadership he had given his best powers and last strength. He had married in December, 1915, Mrs. Edith Bolling Galt of Washington, and she survived at his death in 1924, as did the three daughters of his first marriage.

E. J. W.

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WILSON, a city and county seat of Wilson Co., eastern North Carolina, situated about 50 mi. east of Raleigh. Two railroads serve the city. Tobacco and cotton are the principal crops of the region; fertilizers and truck and bus bodies are the chief manufactures. In 1929 the value of the factory output was about \$5,000,000; the retail trade amounted to \$8,878,278. The city was incorporated in 1849. Pop. 1920, 10,612; 1930, 12,613.

WILSON, MOUNT, a peak of the Sierra Madre range in Los Angeles Co., southern California, about 10 mi. northeast of Pasadena. It rises to an elevation of 5,750 ft. and is famous as the site of the Mt. Wilson observatory of the Carnegie Institution containing the Hooker 100-in. reflecting telescope. The summit of Mt. Wilson commands a splendid panorama of the surrounding mountains and cultivated valleys and can be reached by an excellent automobile road from Pasadena.

WILSON CLOUD CHAMBER, an apparatus devised by C. T. R. Wilson, in 1911, which makes visible the paths of the high-velocity, electrified alpha and beta particles, emitted by radioactive substances (*see* RADIOACTIVITY), and the paths of radiations, such as X-RAYS and GAMMA RAYS, through a gas (*see* RADIATION RAYS). Its importance lies in the fact that it makes possible studies of the action of particles which are invisible. It has led to a clearer understanding of many of the fundamental physical processes.

The apparatus consists of a cylinder, closed by a

glass observation window at one end and by a piston at the other. It is filled with air which is so thoroughly saturated with water vapor particles that a slight lowering of the temperature will cause a precipitation of water drops (dew) on any dust particles or Ions present. When the piston is suddenly pulled out a short distance, the air expands, thus lowering the temperature. A cloud of water droplets is then to be seen in the chamber. A few repetitions of the expansion will clear out all dust particles and ions, so that the cloud no longer forms. Then, if an alpha or beta particle or an x-ray or gamma ray is passed through the chamber immediately following an expansion, small drops of water will collect on the electrified particles (the ions) which have been formed in the gas by the radiation. The path taken by the ray is then visible, although the ray itself is as invisible as ever.

J. B. H.

WILSON DAM, located at Muscle Shoals on the Tennessee River, Ala., is a concrete, gravity type structure 3,100 feet long, adjoining a power house 1,250 feet long. The dam is noted for its large volume of 1,234,000 cubic yards of masonry. The maximum height of the non-overflow section above the stream bed is 98 feet. The concrete spillway section, 2,668 feet long, is 23 feet lower but is surmounted by 58 steel regulating gates, each 18 feet high and 38 feet long. The dam is 100 feet thick at the base. F. K.

WILSON-GORMAN TARIFF ACT, a bill, passed Aug. 24, 1894, and allowed by President Cleveland to become law without his signature, notable as the first tariff act enacted by a Democratic administration since 1857, and for its provision for the taxation of incomes. The House measure introduced by William L. Wilson, providing for a moderation of duties, was in the Senate revised by protectionist interests, led by Arthur P. Gorman, and was unsatisfactory to the rank and file of the Democratic Party. The slenderness of the Democratic majority in the Senate forced the party leaders to admit compromises damaging to the original purport of the act. Coal and iron ore, on the free list in the House bill, were assessed at 40 cents per ton; rates on silks and linens were almost untouched, on cotton goods were slightly downward, and on woolen goods were put at 50 per cent *ad valorem* to compensate for the introduction of raw wool to the free list. The provision for a tax of 2 per cent on all incomes above \$4,000 per annum was on May 20, 1895 (*Pollock vs. Farmers' Loan and Trust Co.*) declared unconstitutional and void by the Federal Supreme Court.

WILSON'S CREEK, BATTLE OF, Aug. 10, 1861, an engagement of the CIVIL WAR in Missouri which resulted in a Confederate victory. Gen. Fremont, commanding the Union operations in the West, neglected to send reinforcements to Gen. Lyon, victor at Boonville (*see* BOONVILLE, BATTLE OF), commanding a small force in southwestern Missouri and over 100 miles from a railroad base. Gen. McCulloch with 12,000 Confederate troops approached Lyon, who anticipated the attack and forced the fighting. Lead-

ing a desperate assault, Lyon was wounded, as were many of his junior officers. The command devolved upon Maj. Sturgis, who ordered a retreat. Of the Union army of from 5,000 to 5,500 men, about 1,250 suffered casualties; McCulloch's loss was 1,095.

WILSON'S THEOREM, proposed by John Wilson (1741-93), states that if p is a PRIME NUMBER then the expression $(p-1)! + 1$ is divisible by p . The *Converse Wilson's Theorem* states that if p is any number, and the expression $(p-1)! + 1$ is divisible by p , then p is a prime number. For example, if $p = 7$, we have

$$(p-1)! + 1 = 6! + 1 = 720 + 1,$$

which is divisible by 7.

WILTON HOUSE, the seat of the Earl of Pembroke, in the village of Wilton (pop. about 2,000; famous for its carpet-making), Wiltshire, England, 86 mi. southwest of London. The imposing quadrangular house was founded on the lands of a dissolved convent by Sir William Herbert, Earl of Pembroke, in the 16th century, and was rebuilt in the 17th century after designs by INIGO JONES. The house has many artistic, literary and historical associations: Sir Philip Sidney wrote his famous *ARCADIA* at Wilton House; Shakespeare is said to have acted there in 1603; and Ben Jonson, Massinger, Van Dyck, and Holbein were among its famous visitors.

WILTS, a plant disease. *See* BACTERIA; FUNGI; PLANT DISEASES.

WINCH, a hoisting machine consisting of one or more drums, on which rope is coiled, the drums being operated by a crank if small weights are to be lifted, but if large then by a steam engine or electric motor through gears. Steam winches or hoisting engines are controlled by the operator opening and closing a throttle valve on the engine, while electric winches have a controller near the motor.

Winches are extensively used on ships for handling cargoes. On ships built exclusively for carrying cargo, at least two winches and sometimes four are located at every mast, each serving one boom.

WINCHELSEA, a village in Sussex, England, situated on a hill above the Romney Marsh, $1\frac{1}{2}$ mi. from the English Channel, 3 mi. southwest of Rye. An ancient town of the Cinque Ports, Winchelsea was till the 15th century one of the busiest Channel ports. The present town was laid out by Edward I (d. 1307). Of particular interest are two ancient gates and the 13th-century parish church. Pop. 1931, 152.

WINCHENDON, a town of northern central Massachusetts, in Worcester Co., situated about 18 mi. northwest of Fitchburg. Two railroads and buses afford transportation. The town lies in the midst of a fertile agricultural region, which produces corn, vegetables and hay. Pine timber is shipped. The principal industries are the manufacture of toys and wood-working machinery, and the production of woodenware, chairs and cotton goods. Winchendon is known as "Toy Town." First settled in 1735 as the Plantation of Ipswich, Canada, it was incorpo-

rated as a town in 1764. Pop. 1920, 5,904; 1930, 6,202.

WINCHESTER, a city of Hampshire, England, lying in a picturesque, rolling country, above the wooded valley of the Itchen, about 66 mi. southwest of London. Traditionally of Celtic origin, it was an important Roman center, and later, when the Kings of Wessex became sovereigns of all England, it was the capital of the country. The Conqueror and several of his successors were crowned at Winchester as well as at London which, until the 12th century, it continued to rival. The Anglo-Saxon Chronicle was compiled in the city, and the castle, now in ruins, contains a round table traditionally King Arthur's. The minster to the north of the cathedral (*see* WINCHESTER CATHEDRAL) was founded by King Alfred. There are also St. John's Hospital and Chapel, unique almshouses, and the Tudor God Begot House. Winchester's college is the oldest public school in England, having been founded in 1382. Pop. 1931, 24,000.

WINCHESTER, a city in eastern Kentucky, the county seat of Clark Co. It is situated 18 mi. southeast of Lexington and is served by two railroads. Winchester is in the Blue Grass Region, noted for its fine horses and cattle. Tobacco is the chief crop. Winchester has creameries, flour and lumber mills and furniture, tobacco hogsheads and clothing factories. It was settled in 1792 and chartered in 1794. Pop. 1920, 8,333; 1930, 8,233.

WINCHESTER, a town and village in Middlesex Co., eastern Massachusetts. The village is situated at the head of upper Mystic Lake, eight mi. northwest of Boston; served by the Boston and Maine Railroad. There are some manufactures, chiefly leather products and gelatin. The factory output in 1929 was valued at approximately \$8,000,000 and the retail business amounted to \$4,475,470. Winchester is essentially a residential community, surrounded by beautiful hills. It includes two attractive ponds. Some of Mystic Valley Parkway and the Middlesex Fells Reservation are within the town. Winchester was separated from Woburn and incorporated as a town in 1850. Pop. 1920, 10,485; 1930, 12,719.

WINCHESTER, a city in northern Virginia, the county seat of Frederick Co., situated about 70 mi. northwest of Washington, D.C., and served by three railroads. The city is set in the beautiful apple-growing section of the Shenandoah Valley, and the chief local industry is apple products manufacture. In 1929 the retail trade reached a total of \$10,038,945. Winchester was founded in 1752 and became a city in 1852. It has many historic landmarks, among them Christ Church, containing the tomb of Lord Fairfax; Ft. Loudoun, built by Washington in 1756; Stonewall Jackson's and Gen. Philip H. Sheridan's headquarters, and the court house used as a prison and hospital during the Civil War. There are Federal and Confederate cemeteries here. Pop. 1920, 6,883; 1930, 10,855.

WINCHESTER, BATTLES OF, three engagements of the Civil War fought near Winchester,

Va. (1) May 24, 1862, the defeat of 5,000 Union troops under Gen. Banks by a Confederate army of 15,000 commanded by Gen. Jackson. The Confederate casualties were 400, the Union losses 904. (2) June 13, 1863, an event of the northern invasion of Gen. Lee's Confederate army: the complete defeat of Gen. Milroy's Federal force of 7,000 by 18,000 Confederate troops under Gen. Ewell. (3) Sept. 19, 1864, the defeat, after five hours' battle, of 15,000 Confederate troops under Gen. Early by Gen. Sheridan's Union army of 40,000. The casualties were about 3,500 on either side.

WINCHESTER CATHEDRAL, Winchester, England, is the longest medieval cathedral in England. It was begun in 1079 by Bishop Walkelin, whose Norman transepts remain, and as it now stands the church contains every style of English architecture from the Norman to the Perpendicular. The earliest Gothic work is the retrochoir, built at the end of the 12th century. The richly carved choir stalls date from about 1305. Prior to 1366, Bishop Edginton began the transformation of the nave from the Norman to the Perpendicular style; this work was carried on by the famous Bishop William of Wykeham, 1366-1404, and was finished by his successors before 1487. The Norman piers and walls, still standing beneath their Gothic covering, produce a remarkable effect of strength with grace and beauty. The groining of the vaults is excellent. The cathedral's special glories, however, are the six beautiful chantry chapels, established by the bishops between 1350 and 1527, that of William of Wykeham, designed by himself, being the most noted of the group.

When the central tower of Winchester fell in 1107, the catastrophe was regarded as a divine judgment upon the overhasty burial beneath the tower of King William Rufus. The tower was rebuilt on massive piers, but it is scarcely higher than the surrounding walls. The exterior is not particularly imposing. The bones of William Rufus, with those of Canute and several other early kings, were later buried in the presbytery. Isaak Walton and Jane Austen are buried in Winchester Cathedral, and Queen Mary Tudor was married here to Philip of Spain in 1554.

WINCHESTER COLLEGE, at Winchester, Hampshire, England, the oldest boys' school of importance in England, founded originally to provide scholars for New College, OXFORD UNIVERSITY. It was founded in 1382 by William of Wykeham as "the Seynt Marie College of Wynchestre," and was opened in 1393-94. The original foundation consisted of a warden, 10 fellows, 16 choristers and 70 scholars. Statutes made in 1400 governed the college till 1857, when it was reconstituted. The present buildings, finely situated on the banks of the river Itchen, form two quadrangles. Of special interest are the chapels, cloisters, dining hall, kitchen, and the red brick school, 1683, containing the famous inscription, "Aut discere aut discede; manet sors tertia-caedi," (Either learn or go; a third choice remains—the cane). There is an elaborate War Memorial Cloister, 1924. The

average number of students is 450. In 1931 the headmaster was Rev. A. T. P. Williams.

WINCKELMANN, JOHANN JOACHIM (1717-68), German art critic and archaeologist, was born in Stendhal, Saxony, Dec. 9, 1717. His father was a poor cobbler, and Johann being unable to complete his course after starting the study of theology and medicine, became a private tutor. He later held the post of librarian to Cardinal Archinto and then served as art connoisseur to Cardinal Albani. His *History of Art of Antiquity* (1764) is the thing for which he is best known. He developed the theory of esthetics and opened up a new era in archeology and criticism. Winckelmann was murdered by thieves on his way to Trieste, June 8, 1768.

WIND, any motion in the air, from any direction or with any speed, but in meteorology usually considered only horizontally. It is observed by the pressure it exerts, the cooling it produces, or the disturbance it creates in small, or light, movable objects. Winds are named after the direction on the compass from which they blow, this being indicated by means of a windvane. The strength of a wind may be estimated and numerically expressed by a number on the **BEAUFORT SCALE**, or its velocity in miles per hour may be directly measured with an **ANEMOMETER**. According to its strength, a wind may be classified from a slight breeze through a wind, a **GALE**, and a **STORM** to a **HURRICANE** with a velocity up to 100 miles per hour.

Winds are caused by a difference in pressure between two localities and blow from a place of high to one of low pressure, their direction being modified by the rotation of the earth, according to **BUYS BALLOT'S** law, but the problem is not a simple one. The winds as observed near the surface of the earth may differ greatly in strength and direction from those prevailing at higher altitudes. Their relation is complicated, and the transfer of wind velocities from one level to another is probably effected by means of whirls and eddies.

Winds may be classified in various ways, according to the regularity with which they blow, one of the simplest being a division into steady, or permanent, periodical and variable, or irregular winds. The former group comprises the trade winds blowing from the tropics toward the equator, in an easterly direction, and the anti-trades, blowing in the opposite direction to the trades, at a higher altitude, the westerly winds prevailing in the northern temperate zone. These winds are due to the general temperature conditions existing on the earth and to its rotation upon an axis from west to east. Under the second group are ranged such diurnal winds as the sea breezes blowing by day, and the land breezes blowing at night, while the third group contains the storms and cyclonic winds. It might be said that the first two groups contain those winds that tend to make the **CLIMATE**, the third group those that produce the **WEATHER**.

The more permanent features of the air motion in

the atmosphere may be roughly classified as follows: Near the equator there is the zone of calm and stillness, the **DOLDRUMS**, with on either side the belts of the **TRADE WINDS**, which blow northeast on the northern hemisphere, southeast on the southern; then two belts of comparative calm, and finally two zones of high winds: the "roaring forties" over the oceans of the southern hemisphere, and the temperate zone belt of continuous production of **CYCLONES** in the northern hemisphere.

Seasonal winds, or winds blowing in restricted localities, have often been given local names, for example, **CHINOOK**, **FÖHN**, **MISTRAL**, **MONSOON**, **NORTHER** and **SIROCCO**. A special form of wind phenomenon is the **TORNADO** in which, in addition to the violent whirling motion where the speed may attain 1,000 miles per hour, there is a strong vertical motion of air.

W. J. L.

WINDBER, a borough in Somerset Co. in southwestern Pennsylvania. It is situated 10 mi. southeast of Johnstown, in the center of an important bituminous coal region, and served by the Pennsylvania Railroad. Farming and lumbering are engaged in, but mining is the more important industry of the vicinity. Windber has fire brick works and several factories. The borough was incorporated in 1900. Pop. 1920, 9,462; 1930, 9,205.

WIND CAVE NATIONAL PARK, situated in the Black Hills of southwestern South Dakota, was created by an act of Congress, Jan. 9, 1903. With subsequent additions to its original territory, it now covers an area of 18.90 sq. mi. and includes a national game preserve for bison, elk and antelope. The cave is a remarkable and extensive series of rooms and passageways carved out of limestone by water, probably both hot and cold. It is believed to have been discovered in 1881 by Tom Bingham, a Black Hills pioneer who heard a weird whistling in the rocks and found it to come from a small hole 10 in. in diameter, the only natural opening to the cave. The wind which blows intermittently in and out of both the natural and artificial entrances is the cavern's strangest phenomenon; it is due supposedly to changes in atmospheric pressure. The cave is also famous for its unique crystal forms, some of which are not known to exist elsewhere.

The park is readily accessible from Hot Springs, Pringle and Custer on the Burlington Route and from Hot Springs and Buffalo Gap on the Chicago and Northwestern Railroad. It is on the Atlantic-Yellowstone-Pacific Highway and can be reached by a side trip from Rapid City on either the Custer Battle Field Highway or the Black-and-Yellow Trail and also from Cheyenne or Orin in Wyoming on the National Park-to-Park Highway.

WINDERMERE, a lake of England, the largest and one of the most beautiful of the country. It is bordered by Westmorland and Lancashire counties and is 10½ mi. long and less than 1½ mi. at its greatest width. Its shores are steep and wooded and indented by inlets and bays. In the center is a cluster

of beautiful isles. The area of the lake is about $5\frac{1}{2}$ sq. mi. and its greatest depth 217 ft. The town of Windermere is on its eastern shore.

WINDFLOWER, a common name for numerous species of *ANEMONE*, mostly perennial herbs of the crowfoot family with showy, slender-stalked flowers which are readily tossed about by the wind.

WINDING, the textile manufacturing operation by which packages of yarn are transformed from one type to another of more suitable form for the process in which the yarn is to be used. Thus, for example, yarn is wound from bobbins to quills, from skeins to bobbins, and from bobbins to cones. Unlike ordinary **SPOOLING**, winding usually so builds up its packages that their ends are self-supporting and do not require the assistance of end disks, called "heads."

WINDLASS in its simplest form consists of a drum for a rope, as for raising a bucket from a well, but there are many modifications and applications as for raising **ANCHORS** of vessels. These machines, known as anchor windlasses, have a sheave (called a wildcat) with grooves into which the links of the anchor **CHAIN** fit, the wildcat being driven through gears or worm and wheel, by a steam engine or electric motor. Windlasses are often built reversible, so they can not only raise an anchor, but also if desired run the chain out of the chain locker. Steam windlasses are controlled by a throttle valve near the engine, and electric windlasses by a controller.

WINDMILLS, contrivances which utilize the energy embodied in movements of the atmosphere to develop power and perform work. They are generally of two types. One consists of four wooden vanes or wings covered with canvas sails, long used in Europe for grinding corn and pumping water. The other, more modern type, familiar in all rural districts, is smaller and comprises a wheel with several metal vanes. It is widely used for pumping underground water. Windmills designed along the lines of the airplane propeller (see **PROPELLER THEORY**) have been used experimentally and to a limited extent for power generation and pumping. On account of the erratic and intermittent behavior of the source of energy, large scale utilization of wind power is not commercially practicable with present equipment.

WINDOW, an opening in a wall for light or ventilation. Windows are a primitive invention, perhaps almost contemporary with the development of enclosed huts or houses. They are especially characteristic of houses not built around courtyards. The Egyptians, Assyrians and peoples of the Aegean civilization all used developed window openings. Egyptian examples still exist in the clearstory windows, filled with pierced stone slabs, of the Hypostyle Hall at Karnak, from the 19th dynasty, and in the simple, framed rectangular openings of the so-called Pavilion at Medinet Abu. From tomb paintings it is known that Egyptian windows were usually hung with rolling curtains of matting. Assyrian windows shown in palace reliefs, 9th and 8th centuries B.C., are long low

openings subdivided by colonnettes, and Aegean windows shown on terra cotta plaques of about 1500 B.C. are rectangular openings subdivided into four by a vertical mullion and a horizontal transom. Wooden shutters probably closed the openings.

Classic Windows. The Greeks used windows only rarely and of the simplest forms; but the Romans not only gave them much study and a highly developed form, but also began the use of glazing. Pliny's letter describing his Laurentine villa (no. 217) gives much space to its windows and the views from them, and mentions the transparent windows in a court. The ruins of the great *thermae* (see **BATHS**) and of the Basilica of Constantine both show large clearstory windows. These were probably filled with a grating of bronze or iron with glass, mica, or shell set in the openings.

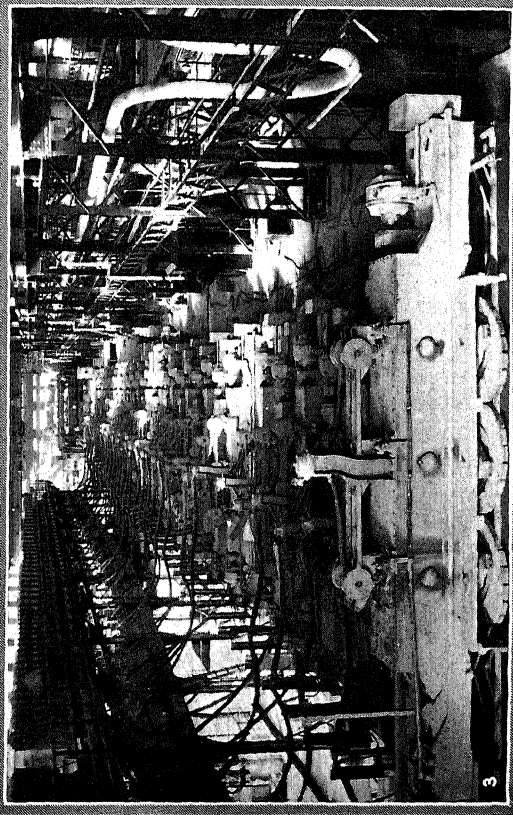
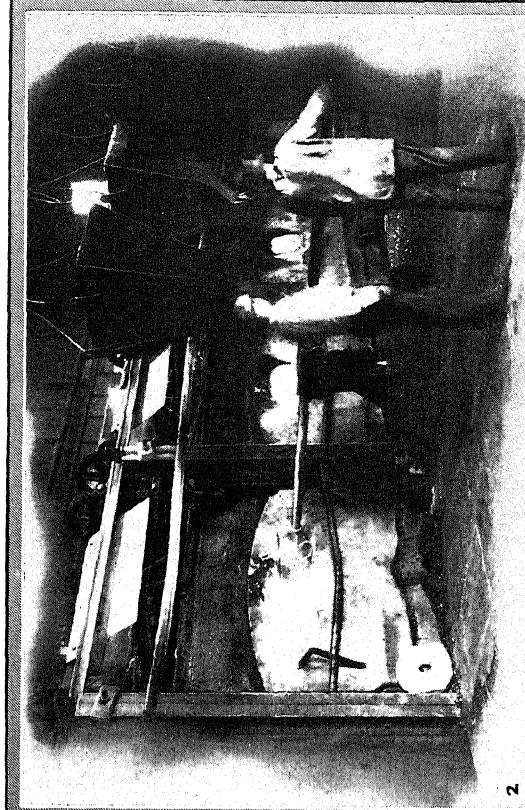
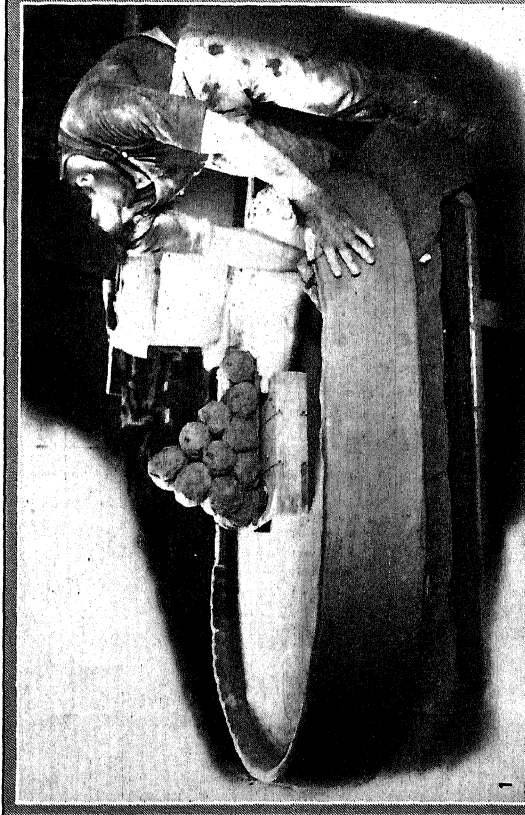
Medieval Windows. The Byzantine builders used windows of pierced marble slabs with glass in the holes; but the Romanesque builders could rarely command the skillful technique necessary, and, moreover, wanted more light than such a window gave. The answer was the use of small round-headed windows, glazed with small panes of glass set in a frame of lead, and the rapid development of the technique of colored or stained glass led in church work to the enlarging of the window sizes. Eventually, in the latter 12th century, this desire for large areas of stained glass produced openings too large to be glazed as a unit. The result was the dividing of the windows into two or more lights, and, in the Gothic period, the development of **TRACERY**.

In domestic and secular work, glass remained rare and costly until a late period. Windows therefore remained generally small, and were often made rectangular because of the ease this form allowed in fitting hinged wooden shutters. Later, when in the 12th century glass began to be used in the better houses, it was set in small wooden frames or sash, and the openings remained rectangular. In the Gothic period the windows were much larger, but the wooden sash could not be made as large; hence arose the use of vertical mullions and horizontal transom bars as subdivisions. On the continent of Europe the tendency was towards windows with four lights, two above and two below, with one mullion and transom. In England, on the contrary, there was a continually growing desire for enormous massed window areas, achieved by a multiplicity of mullions and transoms. The beauty of these ranges of windows of many lights is one of the glories of Tudor and Jacobean design.



DORMER WINDOW, TUDOR
STYLE

WINDOW GLASS



PROCESSES IN THE MANUFACTURE OF WINDOW GLASS

1. Making the pots in which the batch is melted.
2. Inserting the pots in the melting furnace.
3. Automatically feeding the glass to the grinders where progressively over 30 different abrasives are used before it reaches the polishing machine.
4. The glass cut into sheets after coming from thelehr or kiln.

COURTESY LIBBY-OWENS-FORD GLASS CO.

The Renaissance. Outside of church clearstories which could sometimes be modeled on the windows of Roman baths, etc., the Renaissance was without classic window precedents to follow. In Italy the early Renaissance used various types of twinned lights under an enclosing arch; in France, Germany and England the current late Gothic types were used well into the Renaissance. Eventually the simple rectangular opening, usually framed with an architrave or columns, pilasters, and an entablature, became the usual type; often little pediments were placed over the windows. In the early Renaissance windows were frequently glazed with wood-hinged sash filled with small roundels of glass set in lead. Later, as panes of larger size were easier to obtain, the sash were glazed with relatively large panes separated by wooden glazing bars or muntins, and the sash were much increased in size. They usually swung inwards, and the type thus set has remained almost standard on the continent as the French Window. In England late 17th and 18th century windows were glazed usually with double-hung vertically sliding sash, that is, with an upper and lower sash of almost equal size sliding in different grooves in the side of the window. These sash were held at the desired level either by pegs, or by counterweighting them; the counterweighted, double-hug sash is still standard and very widely used in window construction.

The Orient. Windows in the Near East, when given an architectural treatment, are usually filled with an elaborate pierced glazed grille of stucco. In domestic work grilles similarly rich of many spindles of turned wood are common; they are known as *musharabiyeh*. In China and Japan the use of paper, silk, or shell as a window material has also forced the use of wooden sash filled with grille work to give support to the material. Chinese grilles are often complicated patterns of intersecting lines, and are stationary; ventilation is contrived by means of a small rolling section in the covering material. Japanese windows are usually made with horizontally sliding panels; the grille work is of simple rectangular shapes, usually longer than they are high. The sliding sash are arranged to slide open into a projecting pocket at one side of the opening.

Modern Innovations. The most important modern change in window design is the widespread use of metal for frames and sash. Sheet metal locked over a wooden core is sometimes used; but the best modern windows utilize rolled or extruded members of steel or bronze. Both casement and sliding types are made. Particularly interesting is the development of inexpensive stock casements for residences, and of large continuous windows with pivoted ventilators for factories and large buildings. These permit an amount of glass area before unheard of, and large installations are usually fitted with a mechanical device either hand or power driven to control the long ranges of ventilators.

See also, BATHS; FACTORY ARCHITECTURE; GOTHIC ARCHITECTURE; TRACERY.

T. F. H.

WINDOW GLASS has been known since early Roman times when it was cast into panes and used for illuminating baths. As we know it to-day, it was first made by Theophilus, an Anglo-Saxon monk of the 12th century.

Gathering glass on his iron pipe in the customary fashion, blowing a small bubble, and then gathering more and more glass until a sufficiently large mass accumulated, Theophilus blew and shaped the bubble into a cylindrical one. Around the top and bottom of this, he wound a thread of hot glass to crack the cylinder at these points. The cylinder was then scratched on the interior, and slit lengthwise with a hot iron bar. It was placed in an oven, with the crack up, and heated until the glass softened, and the cylinder opened. It was then flattened by means of a paddle and later annealed. This process, usually referred to as the Belgian process, continued in use until the latter part of the 19th century. The cylinders were a foot to a foot and a half in diameter and about five to six feet long. Straight sides were insured by blowing the cylinders in a depression lined with parallel flat walls.

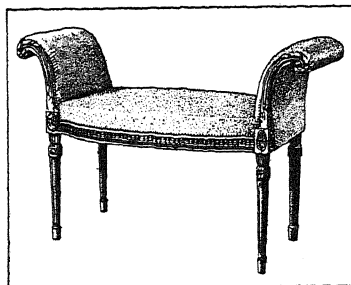
In 1894, J. H. Lubbers, an American, invented a mechanical process in which a large pipe was lowered into molten glass in an open crucible. When the glass adhered, compressed air was forced into the pipe and raised gradually until a bubble of about 30 in. was produced. After that, the air pressure was reduced to slightly greater than atmospheric pressure. The rest of the cylinder was then formed by raising the pipe mechanically and allowing the glass to set as it rose from the pot. The inside air pressure was only enough to prevent the collapse of the cylinder. These cylinders were about 40 ft. long. They were cracked off at the bottom by plunging a cold iron bar into the glass. Then they were lowered on to supports, and that portion adhering to the pipe was cracked off. The cylinders were then cut into lengths of 5 or 6 ft. by scratching with a diamond point, and wrapping with an electrically heated wire. After this, the cylinders were cracked lengthwise into two sections, and flattened, as has already been described. This process enjoyed a world-wide use until 1902, when E. Fourcault of Belgium invented a process for drawing a flat sheet upwards directly from a tank of molten glass. In 1905, I. W. Colburn, an American, independently invented a process for drawing the sheet upwards, and then having it bend and travel in a horizontal position. These two processes are now in extensive operation here and abroad. Their modifications are covered by many patents. It is a safe prophecy that before long the flat glass processes will entirely supplant the cylinder process.

Since the introduction of Lubber's process, window glass has been melted in large rectangular tanks. The batch, or mixture of raw materials, consists of white sand, limestone, soda ash, salt cake and other chemicals melted together at a temperature of about 2500° F. A certain amount of broken glass, or cullet, is

mixed with the batch to utilize waste glass and facilitate melting. A. S.

BIBLIOGRAPHY.—F. W. Hodkin and A. Cousen, *Text-book of Glass Technology*, 1925; Arthur E. Fowle, *Flat Glass*, 1924.

WINDOW SEATS, articles of furniture which were much in vogue in England in the 18th century. They were small stuffed settees, sofas or benches with ends, and were made to fit into deep window recesses. The first window seats are thought to have been designed by THOMAS CHIPPENDALE. These pieces were also made by the brothers Adam (see ROBERT ADAM),



COURTESY M.M. OF ART

ENGLISH WINDOW SEAT IN ADAM-
HEPPLEWHITE STYLE (1780-1790)

but their greatest popularity was developed under GEORGE HEPPLEWHITE, who excelled in the design of small, seemingly fragile articles of furniture. Hepplewhite's window seats, also known as window stools, were somewhat similar to those of Robert Adam. They were Louis XVI in type, covered in rich materials, with no backs and with the ends or arms extending gracefully outward. A Hepplewhite settee or window seat of this description may be seen in the Metropolitan Museum, New York City. See also SETTEE and SOFA.

WINDSOR, a municipal borough of Berkshire, England, lying about 21 mi. west of London on the Thames. The castle upon an eminence above the river, has been the chief residence of English sovereigns since the land on which it stands was acquired by the Conqueror from the Abbey of Westminster. Though considerably altered by successive kings through the centuries, and now covering 12 acres, the castle still follows the original Norman plans. Its massive masonry to-day encloses the wide corridors and private and state apartments that hold treasures of art, tapestries, armor and furniture. The castle chapel of St. George, begun by Edward IV is one of the finest examples of Perpendicular architecture in England. The surrounding parks, of some 2,000 acres, are cut across by the beautiful, elm-lined Long Walk planned by Charles II, and to southward is the artificial lake of Virginia Water. The old town of Windsor, that once boasted 70 inns, yet retains some picturesque old houses. Its fine Italianate town hall is by Wren, and in the parish church are carvings by Grinling Gibbons. The full name of the borough is New Windsor. Pop. 1921, 20,122; 1931, 20,284.

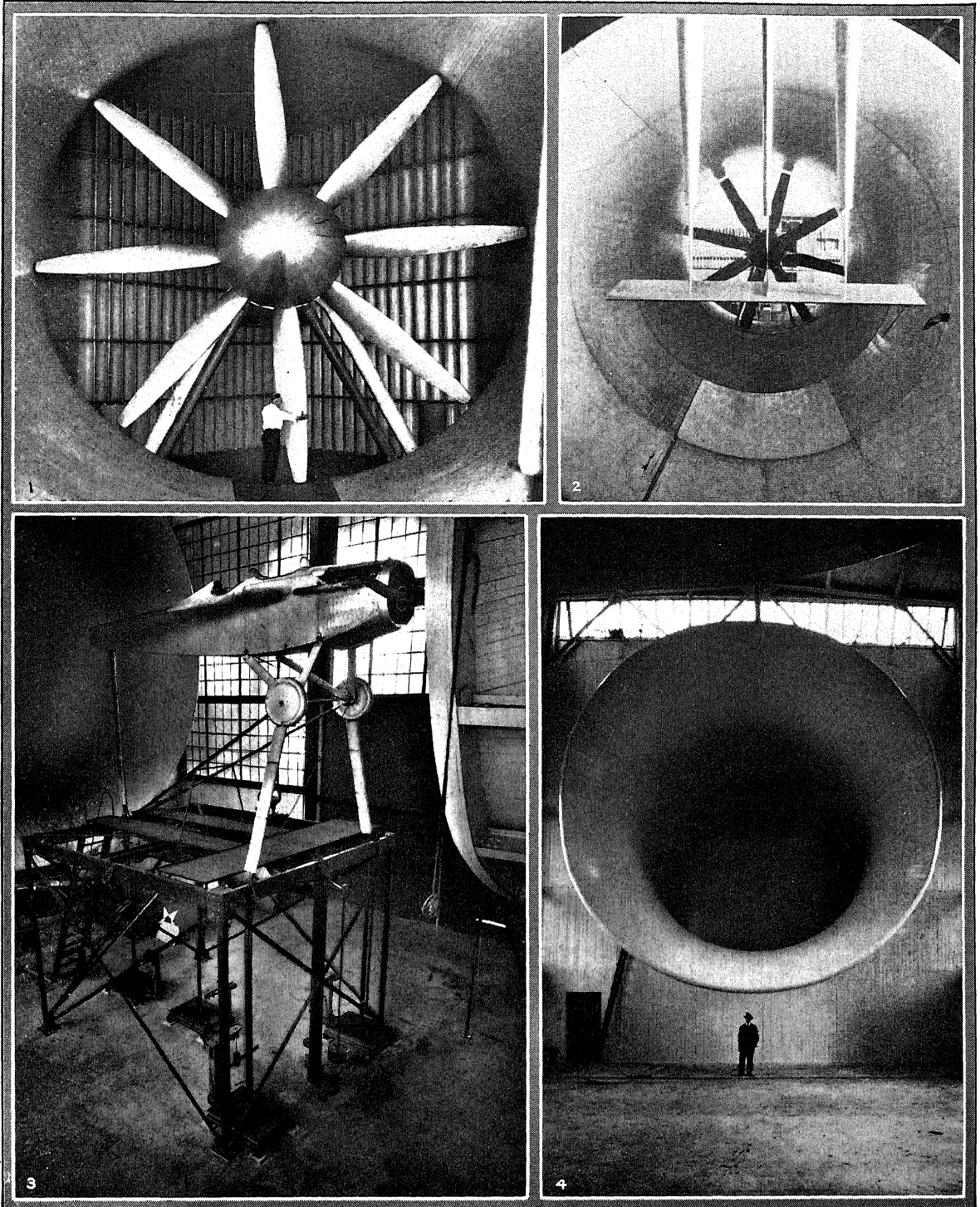
WINDSOR, a city of Essex Co., and a port of entry, Ontario, Canada, situated on the Detroit River, across from Detroit, Mich., and about 254 mi. southwest of Toronto. It is the converging point of five American and Canadian railroads, and the terminus of the Canadian Pacific and Canadian National railroads, and has commercial and passenger traffic served by Great Lakes steamers and the Windsor-Detroit Vehicular Tunnel opened in 1930. Tobacco and fruit-canning factories, and flour and cereal mills are supplied by the produce of the vicinity. Automobile, steel, knitted goods, pharmaceutical products and machinery manufacture and brewing are among the more important local industries. Windsor has numerous fine buildings and public works and contains the suburban homes of many people from Detroit. Pop. 1921, 38,591; 1931, 63,108.

WINDSOR, a town of Hartford Co., in northern Connecticut, situated on the Connecticut River at the mouth of the Farmington River, six mi. north of Hartford. The New Haven Railroad and bus lines serve the town. Windsor's principal industries are tobacco growing and the manufacture of cigar-making equipment. It was the first English settlement in Connecticut, William Holmes having established a trading post here in 1633. The town is a charming residential community with a village green and some fine colonial houses, notably the Ellsworth home, now a museum. Gen. George Dewey's and Gen. Ulysses S. Grant's ancestors were landholders of Windsor. Pop. 1920, 5,620; 1930, 8,290.

WINDSOR, HOUSE OF, the official designation of the British Royal Family, adopted by Royal Proclamation on July 17, 1917. The pedigree can be traced directly to James I, whose daughter, Elizabeth (1596-1662), was married in 1613 to Frederick, Elector Palatine. (See PALATINATE). Their daughter, Sophia (1630-1714), was married to Ernest Augustus, Duke of Brunswick and Elector of Hanover. In 1714 their son ascended the throne of England as GEORGE I. Henceforth, the British Dynasty was known either as the House of Hanover or of Brunswick, and the first four Georges, kings of England, with William IV, reigned over Hanover, which was acknowledged as a kingdom in 1714. Under the SALIC LAW, Queen VICTORIA, as a woman, was ineligible for the Crown of Hanover, which therefore passed to her uncle, the fifth son of George III, namely Ernest Augustus, Duke of Cumberland (1771-1851).

In 1840 Victoria married ALBERT of Saxe Coburg Gotha. Albert's title to this Duchy passed to his second son, Alfred, Duke of Edinburgh (1844-1900), who was succeeded by Alfred's nephew, Arthur Charles Edward, Duke of Albany, the Prince Consort's grandson. During the World War, the dukes of Edinburgh and Albany, being British peers and German princes, were subject to a divided allegiance. On the British side, the anomaly was ended by an Act of Parliament, abolishing the peerages. Germany, on her side, suppressed these and similar sovereignties by declaring a Republic. In 1917 King George V em-

WIND TUNNEL



1, 3, 4. COURTESY NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS; 2. STANFORD UNIVERSITY

WIND TUNNEL INSTALLATIONS

1. The 28-ft. fan in the propeller research tunnel of the National Advisory Committee for Aeronautics, which drives air past the model at speeds up to 110 mi. per hr. 2. Airfoil mounted for test in Daniel Guggenheim Aeronautic Laboratory, Stanford University. View looking

toward tunnel fan and diffuser. 3. Open cockpit fuselage set up for test in the N.A.C.A. propeller research tunnel. 4. Exit cone in the N.A.C.A. propeller research tunnel. This cone is made of wood and is 52 ft. long and 33 ft. across the mouth.

phasized the severance from Germany by substituting Windsor for Hanover as the name of his family.

George V has had six children: Edward, Prince of Wales; Albert, Duke of York; Princess Mary; Henry, Duke of Gloucester; George and John, who died Jan. 18, 1919. The Duke of York married Lady Elizabeth Bowes-Lyon, daughter of the Earl of Strathmore, a descendant of King Robert Bruce. They have two children, Princess Elizabeth, and Princess Margaret Rose. Princess Mary married the sixth Earl of Harewood. They have two children, Viscount Lascelles and Hon. Gerald David Lascelles.

WINDSOR CASTLE, the principal residence of the British sovereigns and one of the finest royal residences in the world, at WINDSOR, Berkshire, England. Begun in the 11th century by WILLIAM I, the castle has been reconstructed, altered and extended by various succeeding monarchs, most notably (in early times) by Henry I, Henry II, Henry III and Edward III, and (in later times) by Charles II and George IV, the latter of whom began the series of reconstructions, under Sir Jeffrey Wyatville, which were completed under Queen Victoria in the 19th century at an approximate cost of \$4,500,000.

The Lower Ward—which contains the Albert Memorial Chapel, the houses of the military knights, the medieval cloisters and the Deanery—is perhaps most notable for St. George's Chapel, one of the finest examples in England of the Perpendicular style of architecture. Begun by Edward III in 1474, it was completed by Henry VIII in the 16th century. It measures 230 ft. by 65 ft., is divided into a nave and choir, and has fine paneled walls and a fan-vaulted stone roof. It contains the chapels of various noble families (Braye, Beaufort, Urswick, Rutland, Lincoln) and is the burial place of many kings, notably Edward IV, Henry VIII, Charles I, and Edward VII. The Albert Memorial Chapel, begun by Henry III, was given its present richly decorated form by Queen Victoria. It contains the tombs of George III, George IV, William IV and other royal personages.

The Middle Ward is occupied chiefly by the Round Tower, an enormous structure erected by Edward III. The Upper Ward contains the state apartments, the royal private apartments, and the visitors' apartments. In many are precious works of art.

The impressiveness of Windsor Castle is further heightened by its two parks, the Home Park and the Great Park, both covering about 2,500 acres.

WIND TUNNEL, an apparatus for moving a stream of air at high velocity over aeronautical models in the study of AERODYNAMICS. As the flow of air about any object is so complicated that its effects have thus far defied complete mathematical prediction, aerodynamics has depended upon experiment with models and upon quantitative data. From measurements on the model in the tunnel, coefficients—depending on the size of the model, the air density and the square of the air speed—are computed. Relying on these coefficients, aerodynamic characteristics of the object are estimated. Sometimes the tunnel is ar-

ranged so that the model is tested in a tube which the air stream entirely fills; in other tunnels, the test is made in a jet of air flowing through an open room. The air current is produced by a propeller-like fan generally operated by an electric motor. This air current is moved at as high a velocity as possible and the wind tunnels are generally made as large as is practical. The first real, though crude, wind tunnel was built in England in 1885 by Horatio Phillips.

The largest wind tunnel, erected by the National Advisory Committee for Aeronautics at Langley Field, Va., occupies a building 434.5 feet long and 222 feet wide, with a maximum height of about 98 feet. The wind is produced by two 4,000 horsepower fans. S. O.

WINE, the fermented juice of fresh grapes. Its color and flavor varies with the variety of grape and method of preparation. The fermentation of grape sugar to alcohol and carbon dioxide is due to the action of ferments known as *Saccharomycetes* which are present on the skins of ripe grapes. These micro-organisms differ in kind according to the species of grape and the soil of the vineyard. Sparkling wines are those which have been bottled while still fermenting, so that carbon dioxide remains in solution. When the wine is poured, the gas escapes. Still wines are those in which carbon dioxide is permitted to escape during fermentation. H. T. B.

Dry wines are those which have been allowed to ferment completely; fortified wines are formed by the addition of brandy or wine spirits after the wine has been only partially fermented. Generally the names of wines are taken from the region which originally produced them or which manufactures them in greatest quantity. Champagne, perhaps the most popular of sparkling wines, is named for the old French province of Champagne. Burgundy, likewise manufactured chiefly in France, includes red (Chambertin) and white (Chablis) dry wines which have fine bouquets. Claret or Bordeaux is a dry red wine produced in the department of Gironde, southwestern France. The dry white Sauterne and the red or white Grave wines have also made this a famous wine region. Port is named after Oporto, Portugal, a large producer, and is a rich, fortified wine, usually red in color. Madeira, another sweet Portuguese wine, is made on the islands of the same name. The district round Jerez de la Frontera, southwestern Spain, is widely known for the still, white Sherry. From Hungary comes Tokay, a rich, sweet wine. Rhine wines, so called for the vine-clad valleys of the Rhine and its tributaries, are generally dry, white and distinguished for their fine aroma. See also LIQUEURS.

WINFIELD, a city in southeastern Kansas, the county seat of Cowley Co., situated on the Walnut River, 48 mi. southeast of Wichita. Three railroads serve the city, through the station known as South Winfield. The region lies within the rich Arkansas River Valley, a splendid farming district. There are oil and gas fields in the vicinity. The city has flour mills, cold storage and packing plants, oil refineries

and machine and wagon shops. It is the seat of Southwestern College, St. John's College and Kansas State Institute for the Feeble Minded. Winfield was founded in 1870 and incorporated in 1871. Pop. 1920, 7,933; 1930, 9,398.

WINGED VICTORY OF SAMOTHRACE, a celebrated Greek sculpture also known as the Nike of Samothrace, discovered on Samothrace, an Aegean island, in 1862 and now in the Louvre, Paris. This is one of the finest examples of the statues the ancient Greeks erected to the goddess of victory, Nike.

WINNEBAGO, a tribe of North American Indians speaking a dialect of the Chiewere group of the Siouan linguistic stock. They lived in the Green Bay region of Wisconsin surrounded by Central Algonkian tribes. Their costumes, dwellings and arts and crafts were similar to the SAUK and FOX and the MENOMINI, though their language, social organization and ceremonies were distinctive. They had both dug-out and bark canoes and used horses.

WINNEBAGO, LAKE, a large body of water in eastern Wisconsin, about 30 mi. long and from 3 to 11 mi. wide. It drains into Green Bay on the northeast, through the Fox River. Fond du Lac, Oshkosh and Menasha are the most important communities bordering the lake.

WINNEMUCCA, a city in northwestern Nevada, the county seat of Humboldt Co. It is situated on the Humboldt River, 170 miles northeast of Reno and served by the Western Pacific and the Southern Pacific railroads. Winnemucca is the center of a rich gold, silver, quicksilver, sulphur and copper mining region, and is an important transportation point for grain, potatoes, vegetables, cattle, horses, sheep and wool. Pop. 1930, 1,989.

WINNEPEGOSIS, LAKE, an irregularly shaped body of water in Manitoba, Canada, lying 50 mi. west of Lake Winnipeg and directly north of Lake Manitoba. It is 130 mi. long, with an extreme width of 27 mi. and an area of 1,995 sq. mi. The elevation is 828 ft. The Waterhen River drains it into Lake Manitoba. Winnipegosis is one of a group of lakes which collects the drainage of the Canadian plains before it is discharged into Hudson Bay through the Nelson River.

WINNETKA, a village and residential suburb in Cook Co., northeastern Illinois, situated on Lake Michigan, 17 mi. north of Chicago. The Chicago and North Western and the North Shore railroads serve the village. The retail trade in 1929 amounted to \$5,346,507. Winnetka was incorporated in 1869, and since 1915 has had the council-manager plan of government. Pop. 1920, 6,694; 1930, 12,166.

WINNIPEG, the capital of the province of Manitoba and the largest city in western Canada, situated at the confluence of the Red and Assiniboine rivers, 40 mi. south of Lake Winnipeg, 60 mi. north of the boundary line between Canada and the United States and almost midway between the Atlantic and Pacific oceans. From a trading post (Fort Garry) in 1870, with a population of 215, Winnipeg has become the

largest grain center in Canada and the chief financial, manufacturing and commercial city of the Canadian West. There are over 1,200 industrial plants, including large abattoirs. Food products, clothing, farm machinery and equipment and footwear are manufactured extensively. The University of Manitoba is situated opposite the fine provincial legislative buildings. The prosperity of the city is reflected in the large structures of Main Street, Pontage Avenue and Broadway. There are 37 public parks with a total area of about 1,032 acres.

The city has made full use of the extensive water-power resources near at hand; one plant has a capacity of 168,000 horse power. For the Winnipeg aqueduct the water is brought from Shoal Lake, near the Lake of the Woods, a distance of 100 mi., by a conduit with a daily capacity of 100,000,000 gals.

The first settlement was made here in 1738 by Verendrye. In 1812 Lord Selkirk's colonists reached the site of Winnipeg by way of Hudson's Bay to Ft. Churchill. In 1822, the year following the merger of the Hudson's Bay Company and the Northwest Company, Ft. Garry was erected. In 1835 it was rebuilt, and the first government was organized. Winnipeg was incorporated as a city in 1873. Pop. 1921, 179,087; 1931, 218,785.

WINNIPEG, LAKE, a large lake in Manitoba, Canada, situated between 50° and 54° N. lat. and 96° and 99° W. long. This is the largest lake in Manitoba with a maximum length of 260 mi., a width varying from 2 to 65 mi. and a water surface of 9,460 sq. mi. Its shores are low and irregular and its waters muddy, a fact which gave the lake its name, i.e., Winnipeg in the Algonquin language means dirty water. The elevation of its surface is 710 ft. and its depth varies from 42 to 90 ft. From the south it receives the Red River which forms a marshy delta at its mouth; and from the west it gathers the waters of the Saskatchewan River whose course from Cedar Lake into this great reservoir is marked by many rapids. From the east Winnipeg River brings it the waters collected by the Lake of the Woods. Lake Winnipeg in turn discharges its surplus volume in a sea-like flood through the Nelson River into Hudson Bay. On its shores are several stations of the Hudson's Bay Company.

WINONA, a city in southeastern Minnesota, the county seat of Winona Co., situated on the Mississippi River, 110 mi. southeast of St. Paul. Bus lines, river craft and five railroads afford transportation. There is an airport. Grain is grown extensively in this region. Winona is a shipping point and manufacturing center. Its chief manufactures are flour, medical goods, sashes, doors and candy. In 1929 the total factory output was approximately \$21,000,000; the retail trade amounted to \$10,902,269. The city is built at the foot of high bluffs on the edge of the river. The countryside is beautiful with bluffs, lakes and woods. Winona is the headquarters of the Mississippi Wild Life and Fish Refuge, established by the government in 1924. An Indian village once oc-

cupied this site. Winona was laid out in 1852 and chartered in 1857. In 1862 it was partially destroyed by fire. Winona is the seat of a State Teachers College, the College of St. Teresa and St. Mary's School for Boys. Pop. 1920, 19,143; 1930, 20,850.

WINOOSKI, a city of northwestern Vermont, in Chittenden Co., situated on the Winooski River, about a mile northeast of Burlington. The Central Vermont Railroad and buses provide transportation. Favored by abundant local water power, Winooski manufactures radios, woolens, cotton goods, screens and other products. It was founded in 1792 by Ira Allen. Pop. 1920, 4,932; 1930, 5,308.

WINSLOW, a town in Kennebec Co., southwestern Maine. It is situated on the Kennebec and the Sebasticook rivers, opposite Waterville and is served by the Maine Central railroad. Farming and dairying are carried on in the vicinity; paper making is the local industry. Winslow was settled in 1674 and incorporated in 1771. Fort Halifax, still standing, was built in 1754. Pop. 1920, 3,280; 1930, 3,917.

WINSOR, JUSTIN (1831-97), American historian, was born at Boston, Mass., on Jan. 2, 1831. He was educated at Harvard, studied at Paris and Heidelberg, and entered the field of journalism, contributing to various periodicals. From 1868-77 he was superintendent of the Boston public library, and from 1877 until his death was librarian of Harvard University. He became an eminent authority upon the early history of North America, and edited *The Narrative and Critical History of America*, which contains critical essays by competent scholars dealing with the source material for the history of European expansion in the New World and the early development of the United States. Among his other contributions to the literature of American history are *Christopher Columbus*, which attracted much attention; *From Cartier to Frontenac*, *The Western Movement*; and *The Mississippi Basin*. In 1886 Winsor became president of the American Historical Association, and in 1897 of the American Library Association. He died at Cambridge, Mass., on Oct. 22, 1897.

WINSTED, a city of Litchfield Co., in northwestern Connecticut, about 25 mi. northwest of Hartford, on the Still and Mad rivers, within the town (township) of Winchester. The New Haven Railroad serves the city. Winsted is a trading point for the agricultural products of the vicinity. It is also an industrial center, manufacturing clocks, hosiery, silk, hardware, knitted goods, electrical goods and insulated wire. The city has developed into a prominent summer resort. Founded in 1756, Winsted became a borough in 1858, and an incorporated city in 1915. Pop. of city 1920, 8,248; 1930, 7,883.

WINSTON-SALEM, a city in northern North Carolina, the county seat of Forsyth Co. It is situated on the Piedmont Plateau, 1,000 ft. above sea level, 30 mi. from the Blue Ridge and 68 mi. northeast of Charlotte. It is served by bus and truck lines, three railroads, and a municipal airport. The principal manufacture is tobacco, the city being one of the

largest tobacco industry centers in the world. In 1929 the total factory output was worth about \$291,000,000; the retail trade amounted to \$31,929,032. Agriculture, especially tobacco-growing, is carried on in the vicinity. Winston and Salem were incorporated as one city in 1913. Salem was founded by the Moravians in 1766, and Winston was established as the county seat in 1849. Pop. 1920, 48,395; 1930, 75,274.

WINTER, WILLIAM (1836-1917), American dramatic critic, was born at Gloucester, Mass., July 15, 1836. In 1859 he was appointed literary critic of the New York *Saturday Press*. In the period from 1865-1909 he was dramatic critic on the New York *Tribune*. In this post Winter wrote vigorous and constructive criticism during the formative period of the American theater, in addition publishing a long list of volumes on Shakespeare, the art of acting, biographical studies of players, and essays on acting and actors. A few of his publications are *The Art and Life of Edwin Booth*, 1893, *Ada Rehan*, 1898, and *The Wallet of Time—Theatrical Criticism and Reminiscence*, 1913. He died at New York City, June 30, 1917.

WINTERBERRY, a deciduous species of HOLLY (*Ilex verticillata*) called also black alder. It is native to swamps and wet woods from Nova Scotia to Wisconsin southward to Florida and Missouri. Although usually a low shrub, it sometimes grows 25 ft. high bearing thick dark green leaves, small flowers and highly ornamental, bright red fruit which persists on the branches until mid-winter. The inkberry (*I. glabra*) is sometimes called evergreen winterberry.

WINTER FAT (*Eurotia lanata*), called also winter sage, a low shrub of the goosefoot family, allied to the greasewood, found on dry plains from Saskatchewan to Texas and westward to California. It grows from 1 to 3 ft. high, with white or rusty-woolly bark, small narrow leaves, greenish flowers,



WINTERGREEN OR CHECKERBERRY

and densely hairy two-horned fruit. In some localities it is utilized for winter pasturage.

WINTERGREEN (*Gaultheria procumbens*), a small, creeping, slightly woody perennial of the heath

family called also partridge berry and checkerberry. It is common, especially in coniferous woods, from Newfoundland to Manitoba southward to Georgia. The slender creeping stems send up erect branches, 2 to 6 in. high, bearing oblong, shining, evergreen leaves; small, usually solitary white flowers on recurved stalks and a globular, bright red, spicy, berry-like fruit. The plant yields the well known oil of wintergreen extensively used in medicine, in perfumery and for flavoring. Several allied plants of the heath family, especially various species of *Chimaphila* and *Pyrola*, are also known as wintergreen.

WINTER HAVEN, a city of Polk Co., in central Florida, situated 45 mi. east of Tampa, and served by two railroads. The city is a winter resort and an important trade and shipping center for a region producing citrus fruits. It has commercial nurseries, fruit packing houses and planing mills. Pop. 1920, 1,597; 1930, 7,130.

WINTER PALACE, the largest palace on the European continent, the winter residence of the tsars, erected in St. Petersburg (now Leningrad), Russia, and facing the Neva river. It is 499 ft. long, 384 ft. broad, 92 ft. high and was completed in 1764. For centuries the palace was the scene of brilliant court balls and entertainments. After 1917 the winter palace was transformed into a museum of the Revolution containing objects connected with various insurrections of the 19th century as well as of the Red Revolution. The apartments of Nicholas I, Alexander II and Nicholas II are preserved as historical memorials.

WINTER'S-BARK, the pungent aromatic bark of an evergreen tree (*Drimys Winteri*) of the magnolia family, native to Chile and Patagonia. Although formerly employed medicinally as an astringent tonic it is now but little used. The bark was first introduced into Europe by Captain Winter in 1579 who had accompanied Sir Francis Drake to the Straits of Magellan.

WINTER SPORTS include skating, snowshoeing, skiing, ice-hockey, ice polo and tobogganing. (See separate articles on these sports.) Winter sports have become increasingly popular and have developed so much within recent years that special resorts in Europe and America now offer unusual advantages to sport enthusiasts. Switzerland has developed her resorts rapidly since the electrification of the Swiss railways and now has more than 90. In the Tyrol district, it is possible to ski until May or June. The leading winter resorts in the United States are in the Adirondack mountain region, particularly at Lake Placid, N.Y., and Hanover, N.H., where a winter carnival is held annually. Canada has a long winter, and the larger cities such as Montreal, Ottawa and Toronto have special winter sport clubs. There is a division of the Olympic games held in the winter which includes events in the leading winter sports. In 1932 these games were held at Lake Placid.

Snowshoeing is the best way of traveling over the snow, and with a knowledge of the proper inclination

of the body it is possible to make good time. Skiing was first used and still is, as a means of locomotion, but it has also developed into one of the most daring sports, using high and specially constructed ski-jumps. Coasting and tobogganing, the latter invented by American Indians and popular in America, are favorite pastimes everywhere. Steep, artificial slopes are now used to give greater excitement. Of the ice sports, there is skating with all its variations, ice hockey, ice polo and curling, all interesting games. Ice-boat racing at great speed is becoming increasingly popular. Winter camping in a tent is possible, if fur-lined sleeping bags are used. Fishing through the ice and hunting are diversions of the camper.

WINTER'S TALE, THE, a comedy by SHAKESPEARE, produced about 1611. It is based chiefly on Robert Greene's *Pandosto*, 1588. Leontes, King of Sicily, jealous of the friendship between his wife, Hermione, and Polixenes, the visiting King of Bohemia, brutally imprisons his wife and plans to kill Polixenes who escapes. A daughter born to Hermione while in prison is left to die, abandoned, in Bohemia, though the baby lives and grows up among some shepherds as the fair "Perdita." Hermione, reported dead, is spirited away by her lady-in-waiting, Paulina. Sixteen years elapse. Florizel, son of Polixenes, falls in love with Perdita and flees with her to Sicily to avoid Polixenes's threat of death to the lovers. Polixenes follows; there is a final scene of reunion and rejoicing when the true identity of Perdita is proved and when, moreover, the gentle Hermione is shown still to be alive. An entertaining minor character is Autolycus, the peddler and thief.

WINTERTHUR, a city of Switzerland, in the canton of Zürich. It has a Reformed and a Catholic church, a cantonal technological institute with a trade museum, a natural history museum and an art gallery. The city is chiefly famous because of its great machine factory, the Swiss locomotive factory, the numerous foundries, cotton and silk mills, chemical factories, lithographic institutes, and its large international trade. As the property of the Count of Kyburg, Winterthur fell to Rudolph of Hapsburg, who granted it a municipal charter in 1264. In 1467 it was sold by Austria to ZÜRICH. Pop. 1930, 53,944.

WINTHER, VILLADS CHRISTIAN FERDINAND (1796-1876), Danish poet, was born at Næstved, July 29, 1796. His father died while Christian Winther, as he is usually called, was still a boy, and his mother married Rasmus Möller, who later attained fame as a poet. Christian Winther studied theology and eventually became a titular professor. His first book of poems, *Woodcuts*, appeared in 1828, but scattered poems had been published before that time. Winther had the gift of interpreting nature in terms of human moods and emotions. Besides several volumes of lyrics, he produced a long narrative poem, *The Flight of the Hart*. He died at Paris, France, Dec. 30, 1876.

WINTHROP, JOHN (1588-1649), first governor of the Massachusetts Bay Colony and a leading Puri-

tan, was born at Edwardston, Suffolk, England, Jan. 12, 1588. He was educated at Cambridge, and for some time practiced law. In 1629 Winthrop lost his post as attorney in the court of wards and liveries, and the same year planned to emigrate to New England, provided the seat of government of the Massachusetts Bay Colony was removed to that colony; he was appointed governor of the "Governor and Company of the Massachusetts Bay in New England," and sailed in Mar. 1630, landing at Salem. He later moved to Charlestown and from there to Boston, which he helped to found. Here, as deputy governor under SIR HARRY VANE, he vigorously opposed the latter's tolerant policy toward ANNE HUTCHINSON. In 1637 he was elected governor in Vane's place, in 1642, and again in 1646, holding the office from 1646 until his death. Winthrop was first president of the United Colonies of New England, which he founded. He was an enthusiastic colonist, devoting himself heart and soul to the welfare of Massachusetts. He died in Boston Mar. 26, 1649.

WINTHROP, JOHN, JR. (1606-76), colonial governor of Connecticut and son of John WINTHROP, colonial governor of Massachusetts, was born at Groton Hall, Suffolk, England, Feb. 12, 1606. He was educated at Bury St. Edmonds and at Trinity College, Dublin. He was a member of the Inner Temple, 1624, but disliking the law he gave it up, as he also did the navy after participation in the English naval attempt to relieve the besieged Protestants at La Rochelle, France, 1627. Afterwards he traveled widely in Europe. He emigrated to Boston, Mass., in 1631, where his father had been a governor for more than a year. He became an Assistant of the colony in 1633 and was prominent in the trading and expanding colonization of Massachusetts. He was one of the first to engage in the colonial manufacture of iron. He was in 1635 appointed governor of the abortive colony of Connecticut which was planned by Lord Say and Sele and Lord Brook at the mouth of the Connecticut River. The undertaking turned Winthrop's interest in that direction and in 1646 he obtained from the Massachusetts General Court a grant to Fisher's Island, which was confirmed a year later by Connecticut. He had already erected buildings (1644) on Fisher's Island and in 1646, he with others founded New London. For several years, he was an inhabitant of both colonies. He continued to act in his capacity of a Massachusetts magistrate until 1650, holding a similar position in Connecticut after 1647. He established his residence at New London in 1650, from where he directed his numerous enterprises. He moved to New Haven in 1655 and to Hartford in 1657 upon his election as governor. The colony had a law which forbade the holding of the office of governor for two successive years. Winthrop, therefore, from 1658-59 was deputy governor, and upon his return to the governorship in 1659 the law of limitation was abrogated and he occupied the office from then until his death. With the Restoration, he journeyed to England and in 1662 obtained a charter

for Connecticut from Charles II. During this visit to England, he was elected to membership in the Royal Society. He died in Boston, Mass., Apr. 5, 1676.

WINTHROP, ROBERT CHARLES (1809-94), American orator and legislator, was born at Boston, Mass., May 12, 1809. He received his education at Harvard, where he was graduated in 1828. After studying law with Daniel Webster, Winthrop was admitted to practice in 1831, and soon allied himself politically with the Whig element. He was elected to the Massachusetts legislature for 1834-40, and when Webster resigned from the Senate in 1850, Winthrop was appointed to serve the unexpired term. He failed of election to the Senate in 1851, and failed of election the same year to the governorship of Massachusetts. After the dissolution of the Whig party in 1854, he made many political addresses as an independent conservative, and strove for a compromise between North and South. In 1856 he backed Millard Fillmore, in 1860 John Beel, and in 1864 George B. McClellan for President. An effective orator, he spoke when the cornerstone of the Washington Monument was laid in 1848 and in 1885 when the monument was completed. He died at Boston on Nov. 16, 1894.

WINTHROP, THEODORE (1828-61), American novelist and soldier, was born at New Haven, Conn., Sept. 22, 1828, and graduated at Yale in 1848. After pursuing various occupations, including the practice of law, he devoted himself to writing novels. His best known works are *Cecil Dreeme*, 1861, *John Brent*, *Edwin Brothertoft* and *The Canoe and the Saddle*, 1862. During the Civil War Winthrop served as military secretary to Gen. Butler with the rank of major, and was killed in the Battle of Big Bethel, June 10, 1861.

WINTHROP, a town and residential suburb, 5 mi. northeast of Boston, in Suffolk Co., Mass. The Boston, Revere Beach and Lynn Railroad serves the city. The town is a seaside resort of beautiful homes, hotels, yacht clubs and similar features. The retail trade in 1929 amounted to \$4,121,537. Winthrop separated from North Chelsea and was incorporated in 1852. Once known as Pullen Poynt, because of the difficult rowing boatmen experienced in rounding the peninsula, the present name was chosen in honor of Deane Winthrop, a 17th century resident, whose home still stands. Pop. 1920, 15,455; 1930, 16,852.

WINTHROP COLLEGE, at Rock Hill, S.C., an institution for women, was founded at Columbia, S.C., in 1886, with the aid of the Peabody Board, and was named for Robert C. Winthrop, chairman of that body. It was chartered in 1891 and passed into state control. The institution was removed to Rock Hill in 1895. It is financed by state appropriations. The grounds and buildings were valued in 1931 at \$3,349,649. The library contained 47,000 volumes. In 1931-32 there were 1,623 students and a faculty of 81, headed by Pres. James P. Kinard.

WINTON, a borough of Lackawanna Co. in northeastern Pennsylvania, situated on the Lackawanna River, 9 mi. northeast of Scranton; it is served by

three railroads. The region has extensive anthracite coal fields, and mining is the principal local industry. Pop. 1920, 7,583; 1930, 8,508.

WINTUN, one of the two divisions of the North American Indian Wintun or Copehan linguistic stock, the second being the Patwin. In numbers and territory they were the largest group in northern California and in the entire State were exceeded only by the Shoshoneans and Yokuts. Their territory consisted of a long narrow strip bounded on the south by San Francisco Bay and the Sacramento River and extending north up the west side of the Sacramento Valley to the crest of the Coast Range. Dried salmon, roots, nuts, berries and raw clover herbage were their chief articles of diet. They were inclined to obesity.

WINZE, in mining, an excavation of small cross-section, driven downward from a **DRIFT**, usually in the ore body. When connected with a lower **LEVEL**, it serves as a passage-way, for men, air and ore. It is frequently the opening from which stoping (see **STOPE**) is started. See also **MINING**, **METAL**.

WIRE may be made readily of copper, steel, nickel, platinum, silver, iron, aluminum, or gold; or alloys of these metals. The material of which a wire is made must be ductile, flexible, and have sufficient tensile strength for the service in which the wire is to be ultimately used.

Wire drawing was known in the 14th century but machinery used in the process was not perfected until the 19th century. Material to be made into wire is usually received at the mill in the form of billets, is rolled through several stages down to a rod and then drawn through successively smaller dies and reduced to the desired size. The rolling processes are carried out while the material is hot, but the drawing processes are usually made with cold rod. The dies are made of specially hardened steel, diamonds, or rubies. Fine wire may be drawn through 25 to 30 dies.

Barbed wire is an American invention of the last century. It is made by twisting at intervals short lengths of sharpened steel wire around two or more longitudinal wires. Barbed wire has been used extensively in agricultural development and property protection. It has been of enormous value to military science during the wars of the last half century.

Steel wire and wire netting are used to-day extensively for reinforcing concrete in buildings and roadways. The tremendous advance in electrical science has been made possible by copper wires. Also in the electric field tungsten wire is used for lamps. As insulation for electrical wires various materials are used, such as rubber, paper, cotton, silk, and enamel. The industry of making insulated wire for electric service has grown enormously in recent years.

Smaller sizes of wire are usually designated by gauge numbers. The Brown & Sharpe or American wire gauge is used in the United States for copper wires and the British wire gauge for steel wires. For copper wire sizes larger than a No. 4/0 in the American wire gauge, wires are usually designated by their area measured in circular mils. A circular mil is the

area of a circle one thousandth of an inch or one mil in diameter. The area of any wire in circular mils is the square of the diameter measured in mils.

European practice is to specify wire sizes in square inches or square millimeters. For conversion into American practice, the following factors are used:

To convert square inches to circular mils, multiply by 1,273,210.

To convert square millimeters to circular mils, multiply by 1974.

E. W. D.

WIRED WIRELESS, communication by the transmission over wire lines of modulated high-frequency currents usually permitted to radiate **ELECTROMAGNETIC WAVES** from an **ANTENNA**.

WIRELESS, the term given to the radiation of **ELECTROMAGNETIC WAVES** through space. The term is ordinarily applied in cases when the radiation can be controlled to carry intelligence. Usually, the waves are long, compared to electromagnetic disturbances on optical wave lengths. The terms wireless and radio are sometimes loosely used to differentiate between code and phone transmission.

WIRE-WORM, a term properly applied to the larvæ of click-beetles (family *Elateridae*). They are long, slender, cylindrical creatures, brownish or yellowish in color, tough and wiry looking. Some live under the bark of trees and in rotten wood. Others live in the ground, feeding on seeds and the roots of grass and grains. By attacking the roots of young plants, or destroying seeds before these have germinated, they do much damage to crops. The larval stage may last several years. Fall plowing, rotation of crops and cultivation are the only means of control. The term wire-worm is sometimes applied also to various species of "thousand worms," as well as to a nematode worm parasitic in sheep.

WIRT, WILLIAM (1772-1834), American lawyer and author, was born in Bladensburg, Md., Nov. 8, 1772. He attended local private schools until the age of 15 when he obtained employment as a tutor, continuing his own studies, including that of law. He was admitted to the bar in 1792, and commenced the practice of law at Culpepper Court House, Va. In 1799 he moved to Richmond where he was for brief periods clerk of the House of Delegates, and chancellor of the eastern district. He turned to writing in addition to his political and legal duties, and his *Letters of a British Spy* which was first published serially in 1803 established his reputation as an author.

Wirt acted as Government counsel in the trial in 1807 of AARON BURR for treason. During the trial he delivered a lengthy grandiloquent speech which was for a period a favorite for school-boy recitations. Several volumes of sketches by him were published, including the popular *Sketches of the Life and Character of Patrick Henry*, 1817. He was a delegate to the Virginia legislature in 1808 and in 1816, President JAMES MADISON appointed him District Attorney for Virginia. Admired for his legal knowledge and his forensic oratory, he was appointed Attorney General

by JAMES MONROE, in 1817 and continued in office by JOHN QUINCY ADAMS, serving 1817-29. Wirt declined, in 1826, the appointment of president and professor of law at the newly founded University of Virginia. He resumed his law practice in Baltimore in 1829. As presidential candidate in 1832 of the Anti-Masonic Party, he received the electoral votes of Vermont. He died in Washington, D.C., Feb. 18, 1834.

WIRT, WILLIAM ALBERT (1874-), American educator, was born in Markle, Ind., Jan. 21, 1874. Following graduation at De Pauw University in 1898 he took post-graduate work there and at the University of Chicago. Subsequently he studied educational methods in Europe. While superintendent of schools at Bluffton, Ind., from 1899-1907, and later at Gary, Ind., he attracted wide attention by his original and advanced system of education. Wirt was engaged in 1914 to install the same system in the New York City schools.

WISCONSIN, one of the North Central States of the United States, popularly called the "Badger State." It is situated between 42° 30' and 47° 3' N. lat. and 86° 49' and 92° 54' W. long. On the north



WISCONSIN STATE SEAL

it is bounded by Lake Superior and the northern peninsula of Michigan, on the east by Lake Michigan, on the south by Illinois, and on the west by Iowa and Minnesota, from which it is separated by the Mississippi River, Lake St. Croix and the St. Croix River. Wisconsin comprises an area of 56,066 sq. mi., inclusive of 810 sq. mi. of water surface. In addition

the state has jurisdiction over 9,878 sq. mi. of water surface in lakes Michigan and Superior. The length of the state from north to south is 320 mi. and the width from east to west is 295 mi. In size Wisconsin ranks twenty-fifth among the states of the Union.

Surface Features. The whole of Wisconsin lies within the central lowlands of the United States. Its surface is comparatively level with a mean elevation above sea level of 1,050 ft., and a relief varying from 581 ft. on the surface of Lake Michigan to 1,940 ft. on Rib Hill in Marathon Co. Practically all the northern part of the state belongs geologically to an extension of the Laurentian Uplands of Canada, which is marked locally by isolated monadnocks and low ranges of hills. The Penokee-Gogebic iron range, extending from Iron Co. northeastward into Michigan, is characteristic of this region.

A remarkable feature of the state is the driftless area in the southwestern part. It is unique in being an unglaciated district entirely surrounded by glaciated land. A long period of erosion, beginning before the glacial period, has stripped all softer formations from the most resistant rocks which now protrude above

the general level in the form of towers and crags in fantastic shapes.

The driftless area has no lakes whereas the glaciated parts of the state have thousands, mostly small. Lake Winnebago is the largest. A low watershed running generally north and south through the center of the state sends part of the drainage to the Mississippi and part to Lake Michigan.

Climate. By reason of its interior position, Wisconsin is subject to marked extremes in climate except in the east and northwest where conditions are modified by the Great Lakes. The mean annual temperature is 43.2° F., ranging from an average of about 39° F. in the northeast to 47° F. in the southwest. At Madison, near the center of the state, the average for January is 16.7° F. and for July, 72.1° F. During the period 1891-1930 the lowest temperature recorded in Wisconsin was -54° F. and the highest, 111° F. The average annual precipitation is strikingly uniform throughout the state, averaging 30.6 in. including 45.7 in. of snow. The average growing season ranges from about 75 days along the northeastern border to 170 days in the southeast.

Forests and Parks. Of a total land area of 35,363,840 acres, approximately 30,080,000 acres were originally forested. Practically all of the original heavy forest cover has been cut over at least once but second growth forests are now being actively protected and developed under the supervision of the State Board of Forestry. The northern part of the state is covered with a coniferous forest of white pine, hemlock, tamarack, spruce, cedar and balsam fir. Common trees in the south are birch, beech, maple, basswood, oak and ash. Wisconsin has 100,000 acres in state forests located chiefly in Vilas and adjoining counties. Nine state parks with a total area of 85,400 acres contain forests, lakes, creeks and rivers, cliffs, gorges and wooded bluffs of outstanding scenic beauty, unique rock formations or points of historic significance. (See NORTHERN FOREST PARK and DEVILS LAKE PARK.) Both forests and parks offer excellent opportunities for camping, bathing, fishing, and boating. In each of the parks is a game refuge in which no hunting or trapping is permitted at any time. A 60-acre tract on the banks of the Wisconsin River containing an old shot tower cut through solid limestone rock has been set aside as the Tower Hill State Monument. The First Capitol at Belmont in Lafayette Co. with the original building restored and the historic Cushing Homestead in Waukesha Co. are also state monuments.

Minerals and Mining. When compared with the output of its farms and factories the mineral productions of Wisconsin are of minor importance. Valuable deposits of iron ore (hematite) occur in the Penokee Gogebic and Menominee ranges near Lake Superior. Zinc-bearing ores are mined extensively in the southwestern part of the state in districts formerly worked for lead.

With mineral products in 1929 amounting to \$24,222,229 Wisconsin stood thirtieth among the states,

ranking fourth in iron ore and pyrites, seventh in lime and ninth in limestone. The principal products in order of value were stone, 4,004,200 tons, \$6,166,708, including limestone, \$3,406,692 and granite, \$888,195; iron ore, 1,789,721 tons, \$4,848,978; sand and gravel for construction, 10,727,632 tons, \$4,574,182; zinc, 16,986 tons, \$2,242,152; and silica, \$216,673.

During 1929 161 mines and quarries gave employment to 3,333 persons who received \$5,128,579 in salaries and wages.

Soil. Wisconsin exhibits a great variety of soils. At one time the state was extensively glaciated and much of its area is now covered with soils derived from the deposits of the drift sheets. Various other soils found in the state have resulted from the decomposition of the underlying rocks resulting in sands, loams and clays. Among the most fertile are the soils consisting of rich alluvium found in the bottom lands of the larger rivers. However, in western Wisconsin there are large areas covered by a thick layer of loess, a siliceous deposit, which rivals the alluvium of the river valleys in fertility. Due to the presence of numerous lakes, lake sands and clays, often containing some marl, occur throughout Wisconsin.

Agriculture. The principal agricultural products are hay and grain, utilized extensively in the dairy industry.

In 1930 21,874,155 ac. or 61.9% of the entire land area was in farms, 181,767 in number, with an average size per farm of 120.3 ac. and an average value per acre of \$79.16. Of the farm area 10,206,455 ac. or 47% was crop land; 8,822,623 ac., or 40%, pasture land; and 1,265,435 ac. or 6%, woodland. The total value of farm property was \$2,209,600,817, of which \$1,731,517,017 was represented by land and buildings; \$170,278,658, by implements and machinery; and \$307,805,142, by domestic animals.

According to the census of 1930 Wisconsin produced in 1929 field crops to the value of \$228,133,192, ranking thirteenth among the states. It stood first in hay, fifth in oats, barley and rye, and eighth in tobacco; it ranked first in peas, second in cabbage, third in cranberries, fifth in potatoes and eleventh in all vegetables harvested for sale. The chief crops were hay and forage, \$99,743,804; grain, \$77,473,938; vegetables, including potatoes, \$38,632,489; tobacco, \$6,493,447, and fruit, \$4,760,648.

Hay, grown on 3,694,889 ac., yielded 6,226,633 tons, of which timothy and clover contributed 4,189,641 tons and alfalfa, 818,140 tons. The leading grain crops were: oats, grown on 2,144,734 ac. yielding 68,694,665 bu.; corn, 1,941,830 ac. of which 973,959 ac. cut for silage yielded 7,633,655 tons and 716,068 ac. harvested for grain produced 26,019,264 bu.; barley, 649,707 ac., 18,646,647 bu.; rye, 187,799 ac., 2,144,707 bu., and wheat, 94,387 ac., 1,835,704 bu.

Potatoes produced on 215,154 ac. yielded 20,589,825 bu., valued at \$24,707,790. Other vegetables harvested for sale were grown on 143,809 ac. with a total value of \$8,314,476, including green peas, \$3,676,672, and cabbage, \$1,670,274. The principal fruits were apples,

1,966,867 bu.; cherries, 164,187 bu.; strawberries, 4,473,404 qts.; cranberries, 2,736,391 qts.; and raspberries, 1,159,353 qts.

During the decade 1920-30 there was a marked increase in the use of modern machinery and other facilities. Automobiles on farms rose from 18,525 in 1920 to 176,764 in 1930; motor trucks, from 4,044 to 51,786; and tractors, from 9,407 to 50,173. Farm products sold by cooperative marketing rose from \$28,884,215 in 1919 to \$42,544,056 in 1929, and farm supplies purchased by this method from \$3,562,996 to \$5,194,350.

Animal Industry. Dairying is preeminently the leading farm industry. According to the census of 1930 Wisconsin ranked first among the states in number of milk cows and in value of dairy products sold. The state stood third in the number of cattle on farms and in the total value, \$307,805,142, of all domestic animals. Among these were 3,536,603 cattle reported from 169,646 farms, or 93% of all farms in the state, and valued at \$220,293,045; 545,936 horses valued at \$51,945,104; 1,611,993 swine, \$18,671,225, and 584,608 sheep, \$4,446,805.

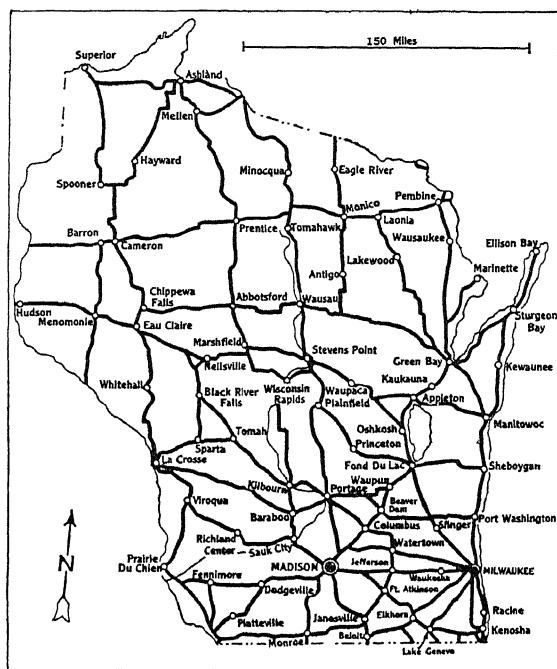
Of the cows on farms, 2,170,273 were kept mainly for milk production and 36,370 mainly for beef production. In 1929 1,241,337,856 gals. of milk were produced; the total value of all dairy products sold was \$223,712,295. The value of all poultry raised was \$19,217,347, the number and value of the chief kinds being chickens, 19,959,817, \$17,555,666; ducks, 500,804, \$569,748; geese, \$269,634, \$551,164, and turkeys 177,116, \$540,769. The value of chickens sold was \$7,389,113. Of 89,500,076 doz. chicken eggs produced valued at \$26,198,256, 64,143,811 doz. valued at \$18,793,319 were marketed. The wool clip, 2,716,113 lbs., was valued at \$887,003. In honey production the state ranked second, with a yield of 5,069,897 lbs., valued at \$752,240, produced from 87,007 hives.

Fisheries. Wisconsin has considerable commercial fishing on Lakes Superior and Michigan and on the Mississippi River, the 1930 catch amounting to 27,798,000 lbs., valued at \$1,830,000. The chief lake species are whitefish, cisco, lake trout and perch, and from the river, buffalo fish, carp, catfish, suckers and sunfish. The inland Wisconsin lakes are famous for their game fish. In 1930, 85,035 fishing licenses were issued, \$225,556 being received in fees. Twenty-three fish hatcheries were operated in 1930 at a cost of \$183,174. The year's output included 9,411,855 trout, 205,731 bass, 302,559,970 other game fish and 30,607,000 commercial species. The U.S. Bureau of Fisheries has an important station at La Crosse for the rescue of fish from the annual overflow of the Mississippi River, and in 1930, 146,000,000 fish were returned from flooded territory to the river. In addition 32,914,325 catfish, 622,665 carp, 6,000,000 cisco, 9,068,285 crappie, 8,495,310 sunfish, 1,650,000 pike perch, 540,000 yellow perch, 1,082,000 trout, and 10,800,000 other species were planted in state waters.

Transportation. Its long coastlines on Lake Superior and Lake Michigan assure Wisconsin of

ample facilities for transportation by water. Although the Mississippi River, which forms the western boundary of the state, has been practically superseded by the railroads as a transportation artery, its availability acts as a check on excessive land transport rates. Milwaukee, on Lake Michigan, the largest port, affords communication with Atlantic coast and foreign ports via the Great Lakes waterway system. The state's first railroad ran westward from Milwaukee in 1851, and reached the Mississippi River at Prairie du Chien in 1857. Development from this point was rapid. Wisconsin is now honeycombed with an adequate railway network which had a total mileage of 7,333 in 1930. The principal systems include the Chicago and Northwestern, the Milwaukee and the Minneapolis, St. Paul and Sault Ste. Marie lines.

The highway system has shown steady improvement and expansion. There were 109,230 mi. of



WISCONSIN STATE ROADS

highways on Jan. 1, 1930, including 27,815 mi. of surfaced roads and 8,880 mi. of improved state highways. During 1929, highway expenditures were \$41,608,015, of which \$16,283,862 was paid by the state and \$25,324,153 by county and local governments. Gasoline consumption in 1930 aggregated 437,878,000 gals. The state gasoline tax that year produced an income of \$8,314,841 as against \$5,209,805 in 1926. Motor vehicle registrations were 782,562 in 1930 compared with 594,386 in 1925. The rapid growth of trucking transportation facilities is indicated by registrations, which rose from 66,296 in 1925 to 105,110 in 1930, or over 60%. The number of buses in operation increased from 1,128 to 1,272 during the same period.

Manufactures. Since 1900 there has been a remarkable expansion in manufactures. During the 30-year period 1899 to 1929 the factory output increased in value 500%. Important factors in this growth were the development of the dairy industry, in which the state has attained foremost rank, and the great advances made in motor vehicle manufacture.

According to the Census of 1930 Wisconsin with manufactures for 1929 valued at \$2,156,681,769 stood tenth among the states. Its 7,431 establishments gave employment to 44,652 officers and employees, who received \$115,033,424 in salaries, and to 264,745 wage earners, who were paid \$352,490,893 in wages. These factories used a total of 1,239,394 horse power, expended \$44,985,996 for fuel and power, and \$1,161,854,091 for material and supplies, and added by the process of manufacture \$949,841,682 to the value of their output.

In this varied output there were 133 separately enumerated groups of manufactures. The state stood first in the production of cheese and condensed milk; second in wood pulp, engines, rubber tires and leather gloves; and third in butter and paper. Wisconsin ranked fourth in motor vehicles, motor vehicle bodies and parts and knit goods, and fifth in beverages. Among the products in which the state stood sixth were boots and shoes, leather, canned vegetables, planing mill products and stoves. It ranked seventh in foundry and machine shop products; eighth in lumber and confectionery, tenth in furniture, eleventh in electrical machinery and twelfth in meat packing.

The principal manufactures, which comprised two-thirds of the total output of the state, in order of value were:

Industry or Product	No. Persons Employed	Value of Products \$
Motor vehicles	11,309	219,192,950
Foundry and machine shop products	29,727	149,058,715
Engines and turbines	14,198	96,392,493
Motor vehicle bodies and parts	14,689	95,296,332
Paper	10,819	93,400,631
Meat packing	3,589	93,312,909
Butter	2,602	71,722,873
Condensed milk	2,130	66,645,329
Cheese	2,137	64,970,802
Boots and shoes	12,155	55,384,784
Knit goods	12,241	51,549,464
Electrical machinery	9,756	48,532,600
Printing and publishing	9,662	47,614,657
Lumber	15,380	44,894,159
Rubber tires	4,556	41,244,345
Furniture	10,044	36,639,762
Wood pulp	3,674	36,058,146
Canned fruits and vegetables	6,062	35,068,403
Bread and bakery products	5,271	34,205,338
Iron and steel rolling mill products	5,881	30,269,020
Leather	4,299	30,015,331

The leading manufacturing cities, with value of output, were Milwaukee, \$700,760,456; Racine, \$132,739,836; Janesville, \$112,418,150; Kenosha, \$97,193,248, and West Allis, \$68,808,937.

Commerce. According to the census of 1930, there were in 1929 3,516 wholesaling establishments in Wisconsin, with total sales of \$979,288,691. These

organizations gave full-time employment to 31,275 men and women whose annual salaries and wages aggregated \$51,139,994. The chief wholesaling center is Milwaukee, with total sales of \$551,552,029.

The total sales of the 39,612 retail stores amounted to \$1,232,338,677. Sales per store averaged \$31,110; sales per capita were \$419.30.

CHIEF RETAIL DISTRIBUTING GROUPS

Group	No. of Stores	Sales	% of Total
Food	9,950	\$269,846,834	21.90
Automotive	6,647	245,045,722	19.89
General Mdse.	3,269	201,018,467	16.31
Lumber & Bldg.	2,825	131,809,451	10.70
Apparel	2,949	92,942,535	7.55
Furn. & Household	1,137	51,246,161	4.16
All other stores	12,835	240,429,507	19.49
Total, all stores	39,612	\$1,232,338,677	100.00

Milwaukee, the principal port, handled water-borne traffic amounting to 8,564,863 tons, with a value of \$486,228,800. Superior, across the harbor from Duluth, Minn., also handles an important volume. Coal, flour, cement and wheat are the most important products.

Finance and Banking. The value of all taxable property in 1928 was \$5,872,402,648. Wisconsin had no bonded debt. Total state revenue in 1928 was \$45,791,517; total disbursements, \$46,072,286. The chief sources of income were property and special taxes, \$14,652,800 and licenses, \$20,147,600. This item included taxes on corporations, insurance companies, motor vehicles and gasoline sales, \$6,281,699. The principal payments were for highways, \$17,814,662, education, \$4,214,385 and permanent improvements, \$2,258,110.

There were 932 banks in Wisconsin in 1930. Of these, 151 were national banks and 781 trust companies and state banks. Their total capitalization was \$71,822,500; their surplus and undivided profits, \$63,388,000. Total resources were \$1,109,114,000, with loans and discounts aggregating \$631,106,000. Demand and time deposits totaled \$875,101,000. Per capita demand and time deposits were \$297.86; per capita savings deposits, \$171.82. The total savings of \$504,809,000 were owned by 1,392,253 depositors. National bank circulation aggregated \$16,632,000.

Government. The legislative body of Wisconsin consists of a Senate composed of 33 members and an Assembly of 100 members; the former elected for terms of four years and the latter for terms of two years. They meet in biennial sessions unlimited in duration. The chief executive is the governor elected for terms of two years at a salary of \$5,000 per year. Other executive officers are the lieutenant governor, secretary of state, treasurer and attorney-general. Judicial power is vested in a supreme court, in circuit courts, courts of probate and in justices of the peace. The supreme court consists of seven judges elected for terms of ten years. The chief justice receives a salary of \$9,000 per year and the other judges salaries of \$8,500 per year.

Social Welfare Institutions. A State Board of Control directs these institutions. There is an industrial school for delinquent boys at Waukesha and for delinquent girls at Milwaukee. An industrial home for women at Taycheedah is for those who have been convicted of lesser crimes and for girls who have grown too old to be kept longer in the Milwaukee industrial school. A similar institution for men called a reformatory is at Green Bay. Colonies and training schools for feeble-minded and epileptics are located at Chippewa Falls and at Union Grove. At Janesville is a school for the blind and in Milwaukee a workshop for the blind. The school for the deaf is at Delavan. Sparta has a state school for the education of physically, mentally and morally sound dependent or neglected children under 16 years of age. A tuberculosis sanitarium is at Statesan and a tuberculosis convalescing camp at Tomahawk Lake. The Wisconsin State Hospital at Mendota is for the insane and also treats drug addicts, alcoholics and those afflicted with venereal diseases. Winnebago also has an insane hospital. The Wisconsin Memorial Hospital at Mendota is for the care and treatment of discharged soldiers, sailors, nurses and marines. A hospital for the criminal insane and the state prison are at Waupun.

Education. The first school was taught by Jacques Porlier at Green Bay in 1791. This was followed by a school at Prairie du Chien in 1817, and a school for Indians conducted by Rev. Eleazer Williams on Fox River in 1823. The first public school was opened in Milwaukee in 1836. In 1927-28, the 8,315 elementary schools had 19,808 teachers, and 520,149 enrolled pupils. The 435 public high schools had 4,768 teachers and 102,483 pupils. Children from 7 to 14 years of age (7 to 16 if unemployed) are required to attend school 6 months annually. The number of persons from 5 to 20 years of age attending school in 1930 was 666,555, or 74.2% of the population within the ages specified, as compared with 551,205, or 67.3%, in 1920. The number of persons, 10 years and over, unable to read and write in 1930 was 44,232, or 1.9%, as compared with 50,397, or 2.4%, in 1920. Foreign-born white illiterates numbered 29,960, or 7.8% of the foreign-born in 1930, and 38,359, or 8.4%, in 1920.

The most important institution of higher learning is the University of Wisconsin at Madison. Other state educational institutions are Stout Institute at Menominee, and normal schools at Platteville, White-water, Oshkosh, River Falls, Milwaukee, Stevens Point, Superior, La Crosse and Eau Claire. The leading private universities and colleges include Beloit College at Beloit, Lawrence College at Appleton, Milwaukee-Downer at Milwaukee, Marquette University at Milwaukee and Ripon College at Ripon. The Wisconsin Free Library Commission has its headquarters in the Capitol at Madison.

Population. In 1930 Wisconsin ranked thirteenth among the states with a population of 2,939,006 or an average of 53.2 per sq. mi., an increase of 306,939

or 11.7% over 1920. The population rose from 305,391 in 1850 to 1,693,330 in 1890, 2,069,042 in 1900, 2,333,860 in 1910 and 2,632,067 in 1920. In 1930 there were 2,913,859 or 99.1% whites, 11,548 or 0.4% Indians, and 10,739 or 0.4% Negroes. Of the whites, 2,527,646 were native-born and 386,213 were foreign-born, a decrease in the latter of 73,915 since 1920. Of the total foreign stock, including foreign-born, foreign and mixed parentage, 608,200 or 41.2% were German, 139,255 or 9.4% Polish, and 135,953 or 9.2% Norwegian. The urban population was 1,553,843 or 52.9% of the total, an increase of 309,275 or 24.8% from 1920; the rural population was 1,385,163 or 47.1% of the total, a decrease of 2,336 or 0.2% from 1920. There were in 1930 four cities of 50,000 and upwards: Milwaukee, 578,249; Racine, 67,542; Madison, 57,899; Kenosha, 50,262.

Occupations. In 1930 1,129,461 persons, or 38.4% of the population, were gainful workers 10 years old or older; 80.9% of these were males and 19.1% were females; 81.5% were native white; 17.6% foreign-born white, and 0.5% Negro. Of the females 15 years old or older 64.4% were single, 22.2% were married and 13.4% were widowed or divorced.

Among the principal occupations, with number of workers, were farmers, 177,432, and farm wage workers, 78,516; factory operatives, 76,096 men and 31,123 women; factory laborers, 59,766, including 17,443 persons engaged in iron and steel industries; salespersons, 29,551 men and 12,855 women; retail dealers, 38,806; clerks, 28,811 men and 18,128 women; servants, 4,156 men and 31,073 women; school teachers, 4,601 men and 21,786 women; building laborers, 25,657; machinists, 22,099; carpenters, 22,023; chauffeurs, 17,796; stenographers, 505 men and 17,078 women; bookkeepers and cashiers, 5,476 men and 10,661 women; painters, glaziers and varnishers, 9,944; mechanics, 9,600, and manufacturing foremen, 9,605.

HISTORY

In 1634 Jean Nicolet, having come westward along the Great Lakes, entered Green Bay, then ascended Fox River past Lake Winnebago before turning southward. RADISSON AND GROSEILLERS traversed the Wisconsin country in 1654 and on a later trading expedition. In 1660 seven traders, with Father René Ménard, the first missionary in Wisconsin, wintered at Chequamegon Bay. In 1665 another Jesuit, Father Claude Allouez, established the La Pointe mission, the first in Wisconsin. Jean Père spent three years, 1668-70, in exploring the Lake Superior region, incidentally locating copper ores. MARQUETTE and JOLIET, LA SALLE, Nicholas Perrot and DU LHUT explored and traded in the Wisconsin region. French plans for exploitation of the fur trade in Wisconsin, and for building a chain of forts linking the Mississippi valley with the St. Lawrence settlements were hampered by the hostility of the Fox Indians and allied tribes, 1712-40. Having gained possession of the region (see PARIS, TREATY OF, 1763) the British

occupied Green Bay, were forced to withdraw by Pontiac's Conspiracy, and returned to dominate—but not to monopolize—the fur trade even after Wisconsin became United States territory (see PARIS, TREATY OF, 1783). The NORTHWEST COMPANY continued to occupy the posts until the War of 1812 terminated British influence in Wisconsin, and United States troops were garrisoned at Green Bay and Prairie du Chien. Successively attached to the Northwest Territory (see ORDINANCE OF 1787), the Territory of Indiana, 1800-09, the Territory of Illinois, 1809-18, and the Territory of Michigan, Wisconsin was in 1836 erected into a separate Territory, including all of Iowa and Minnesota and much of North and South Dakota. The fur trade, largely dominated by the American Fur Company, after 1825 divided importance with the lead mining industry. A series of Indian treaties in 1829, 1831, 1832 and 1833 (see BLACK HAWK WAR) perfected the nation's title to vast arable areas, and in 1834 land offices were opened. In 1830 Wisconsin's white population numbered slightly over 3,000, and in 1836, more than 11,000, the increase being concentrated in the southeastern section of the Territory.

Henry Dodge was the territory's first governor. The first legislative council met at Leslie in 1836, and selected Madison as the permanent capital. Wisconsin was formally admitted to the Union on May 29, 1848. The population of the state had reached 300,000; the stream of German immigration had begun to enter the state. A new political party sprang from this frontier commonwealth in 1854 (see REPUBLICAN PARTY), and in 1856 Wisconsin elected a Republican governor. Enthusiastically loyal, Wisconsin furnished 91,379 troops to the Union armies in the Civil War. Republican liberalism in Wisconsin (see ROBERT M. LA FOLLETTE) antedated progressivism in national politics by several years; the state's enlightened enactments in regard to railway rates, the security of insurance companies, civil service, the conduct of elections, and other matters have served as models for other legislatures. The conservative faction of the Republican party in Wisconsin was uppermost during the World War, when the state was overzealous in suppressing the German sympathies of many of its people. The tradition of liberalism was fully restored, however, in 1928 when Robert M. La Follette, Jr., was reelected to the senate and in 1930 when Philip F. La Follette was elected governor. In 1932 the Democrats, A. G. Schmedeman and F. Ryan Duffy, were elected governor and senator respectively.

BIBLIOGRAPHY.—F. C. Howe, *Wisconsin, an Experiment in Democracy*, 1912; M. M. Quaife, *Wisconsin, Its History and Its People*, 1924.

WISCONSIN, UNIVERSITY OF, at Madison, Wis., a coeducational and state institution, founded in 1848 when Wisconsin was admitted to the Union. It opened as a preparatory school, and added the collegiate department in 1850. The preparatory school was later discontinued. In 1866 when the university received the benefits of the Federal Land Grant Act,

the institution was reorganized, with colleges of Agriculture and Engineering established as integral parts of the university. The institution comprises the colleges of Letters and Sciences, Mechanics and Engineering, Law and Agriculture and the Graduate School. Associated with the university are the United States Forest Products Laboratory, the United States Weather Bureau, the Washburn Observatory, the Wisconsin Psychiatric Institute, the Wisconsin Geological and National History Survey, the State Laboratory of Hygiene and the State Toxicological Laboratory. The grounds and buildings were valued in 1931 at \$12,147,006. The library of 377,500 volumes contains special collections on European and Asiatic, French Colonial, Spanish, and Latin American history and politics; and political science and philosophy, economics and law. In 1930-31 there was a student enrollment of 10,001, exclusive of the summer session, and a faculty of 1,440 headed by Pres. GLENN FRANK.

WISCONSIN RAPIDS, a city in central Wisconsin, the county seat of Wood Co., situated on the Wisconsin River, 40 mi. southwest of Wausau. It is served by four railroads. The Nepco-Tri-City Airport is 2 mi. from here. Dairying is the chief agricultural interest of the vicinity. Cranberry picking is also a profitable rural occupation. Wisconsin Rapids ships a great amount of cheese, and manufactures paper, pulp, camp equipment and various other products. It is the seat of the Government Indian Agency for the Winnebago and Pottawatomie tribes. The city on the east bank of the river was chartered in 1869, and known as Grand Rapids. Centralia, on the opposite bank, was annexed in 1900, and in 1920 the name was changed to Wisconsin Rapids. Pop. 1920, 7,243; 1930, 8,726.

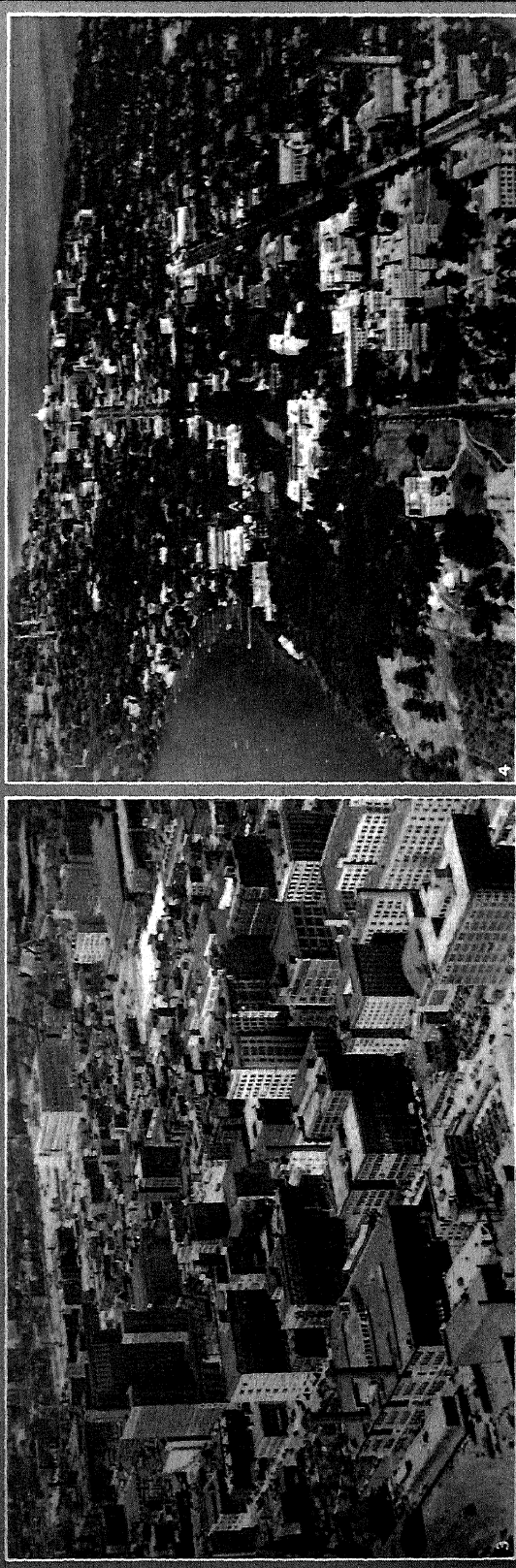
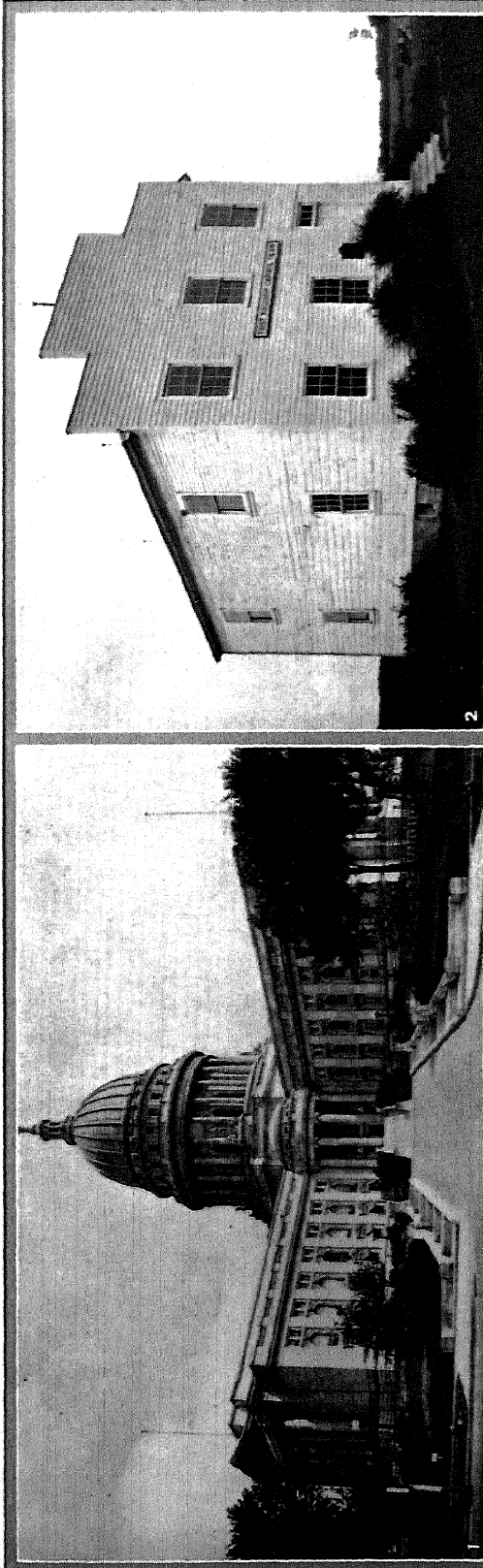
WISCONSIN RIVER, the most important stream of the interior of Wisconsin, rising in Lake Desert on the boundary line between Wisconsin and the northern peninsula of Michigan. The altitude at its source is 1,650 ft. This river flows generally south 300 mi. to Portage and thence west southwest to its junction with the Mississippi River about 4 mi. south of Prairie du Chien. Its total length is 429 mi. and it is navigable to Portage where it is connected by a canal with the Fox River which empties into Lake Michigan. The drainage basin includes 12,280 sq. mi., the topography of which includes nearly every kind found in the state. The northern half is a lake country once having vast forests of evergreens but now partially cleared for farming. The lower basin is a semi-prairie region devoted chiefly to agriculture. The total descent of the river is 1,046 ft. which is concentrated in many places providing valuable power sites, many of which are improved and used by industries. The Wisconsin tributaries are the Yellow, Baraboo, Pine, Pelican, Eau Claire and several smaller streams. The river was an important logging stream before the timber on its upper course was depleted.

WISDOM, BOOK OF, one of the apocryphal books of the Old Testament received in the Catholic canon. It was early ascribed to Solomon. The Latin

Church feels that there is uncertainty regarding the authorship of the book, but holds that it contains the sentiments of Solomon. Most modern scholars ascribe the authorship to a Jew of Alexandria in the 1st and 2nd centuries B.C. Though it makes full use of the Hebrew scriptures, it shows the influence of Greek thought. It relates the parts which Wisdom plays in life and illustrates its power from Jewish history.

WISE, HENRY ALEXANDER (1806-76), American political leader and soldier, was born in Drummondtown, Va., Dec. 3, 1806. He was educated by private tutors, at Margaret Academy, Accomac Co., Va., and at Washington College, Pa., from which he graduated in 1825. He studied law at Winchester, Va., was admitted to the Virginia bar in 1828 and commenced practice in Nashville, Tenn. He returned to Accomac Co., Va. 1830 and in 1832 as a delegate to the first Democratic National Convention at Baltimore. He voted for A. JACKSON. He was elected to the national House of Representatives, as a Democrat in 1833 and 1835; as a Whig in 1837, 1839 and 1841 and as a Tyler Democrat in 1843, serving from Mar. 4, 1833 until his resignation Feb. 12, 1844. He originally was a candidate for Congress in January, 1833 because the principal candidate for the office approved of South Carolina's Nullification and Wise as a believer in the Union regarded South Carolina's conduct as reprehensible. He favored the U.S. Bank, and deplored Jackson's policy of depositing government funds in "pet banks." He also attacked Jackson's endorsement of the spoils system. As late as 1840, Wise agreed with H. CLAY about the bank, but thereafter he regarded it as an outworn issue, opposing a re-charter. He agreed with Tyler's policies generally, particularly with his desire for the annexation of Texas.

He declined the portfolio of the Navy in the Cabinet of President J. TYLER, 1841. He was appointed Minister to France, 1843, but wilful Whig opposition to Tyler in the Senate prevented his confirmation. His appointment as Minister to Brazil in 1844, however, was confirmed and he served until 1847. He was a presidential elector on the defeated Cass and Butler Democratic ticket, 1848, and also a presidential elector on the victorious F. PIERCE and King Democratic ticket, 1852. He was a prominent delegate to the State constitutional convention in 1850. Wise was the Democratic candidate for the governorship of Virginia in 1855, in a contest which attracted nationwide attention. The success of the Native American or "Know-nothing" Party at the outset was generally conceded. Wise in a vigorous campaign affirmed his love of the Union, and denounced his opponents as promoters of sectionalism, and as bigots who were persecuting foreigners and Catholics. Wise was elected, and during his term as governor, 1856-59, John Brown was hanged by the state (1859) for his raid on Harper's Ferry. Wise, as a member of the State secession convention in the spring of 1861 advanced ideas which baffled his colleagues and were



1, COURTESY ASSOCIATION OF COMMERCE, MADISON; 2, WISCONSIN CONSERVATION DEPT.; 3, ASSOCIATION OF COMMERCE, MILWAUKEE; 4, ASSOCIATION OF COMMERCE, MADISON

STATE CAPITOLS OF WISCONSIN AND THE CITIES OF MILWAUKEE AND MADISON

1. Wisconsin State Capitol at Madison.
2. The first State Capitol, as restored at Belmont.
3. Business section of Milwaukee from the air.
4. Aerial view of Madison; Lake Monona lies in the background and Lake Mendota on the left.

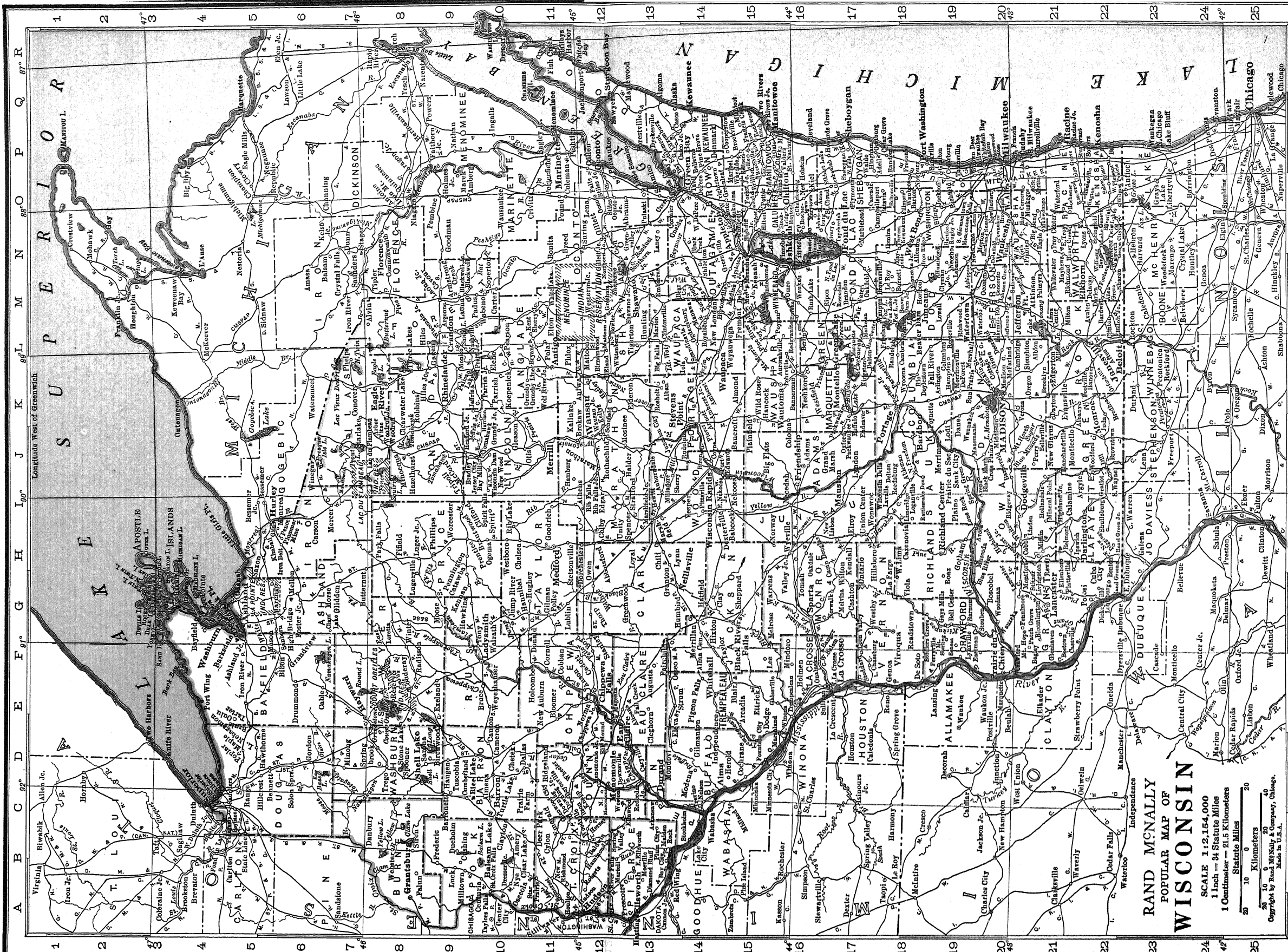
WISCONSIN

Area, 56,066 sq. m.
Pop. 2,939,006

PRINCIPAL CITIES

Pop.—Thousands

- 9 Antigo . . . L 11
- 25 Appleton . . N 14
- 11 Ashland . . . G 5
- 6 Baraboo . . . J 18
- 10 Beaver Dam . . M 18
- 24 Beloit . . . L 22
- 4 Berlin . . . L 16
- 4 Burlington . . O 22
- 10 Chippewa Falls . E 12
- 4 Clintonville . . M 13
- 3 Columbus . . . L 19
- 11 Cudahy . . . P 20
- 3 Delavan . . . M 22
- 26 De Pere . . . S 14
- 23 Edgerton . . . L 21
- 23 Fond du Lac . . N 17
- 6 Ft. Atkinson . . M 20
- 37 Green Bay . . P 14
- 4 Hartford . . . N 19
- 3 Hudson . . . A 12
- 3 Hurley . . . I 5
- 22 Janesville . . L 22
- 7 Jefferson . . . M 20
- 7 Kaukauna . . . P 23
- 50 Kenosha . . . S 14
- 40 La Crosse . . P 17
- 3 Ladysmith . . F 10
- 1 Lake . . . P 20
- 3 L. Geneva . . N 22
- 23 Madison . . . J 12
- 53 Manitowish . . O 16
- 14 Marinette . . P 11
- 9 Marshfield . . H 13
- 9 Mayville . . . N 18
- 9 Menasha . . . N 15
- 6 Menomonie . . C 12
- 5 Merrill . . . J 11
- 578 Milwaukee . . P 20
- 5 Monroe . . . K 25
- 9 Neenah . . . N 15
- 5 New London . . M 14
- 7 N. La Crosse . . F 17
- 4 Oconomowoc . . M 20
- 5 Oconto . . . P 12
- 40 Oshkosh . . . H 8
- 4 Park Falls . . H 8
- 4 Platteville . . O 17
- 6 Portage . . . J 18
- 4 Port Washington . P 18
- 4 Prairie du Chien . . F 20
- 68 Racine . . . P 21
- 3 Reedsburg . . J 18
- 8 Rhinelander . . K 9
- 5 Rice Lake . . D 9
- 4 Richland Center . H 18
- 4 Ripon . . . N 18
- 3 River Falls . . P 18
- 4 St. Francis . . P 20
- 4 Shawano . . M 13
- 39 Sheboygan . . P 17
- 13 Sheboygan Falls . . P 17
- 13 Shorewood . . P 20
- 11 S. Milwaukee . . P 21
- 55 Sparta . . . G 16
- 2 Spooner . . . D 8
- 2 Stanley . . . F 12
- 14 Stevens Pt. . . K 14
- 5 Soughton . . . O 20
- 5 Sturgeon Bay . . O 12
- 36 Superior . . . O 4
- 3 Tomah . . . G 16
- 3 Tomahawk . . J 10
- 10 Two Rivers . . O 15
- 3 Viroqua . . . P 18
- 2 Washburn . . F 4
- 11 Watertown . . M 19
- 17 Wausau . . . N 20
- 3 Waupaca . . L 14
- 2 Waupun . . . H 18
- 21 Wauwatosa . . P 20
- 35 West Allis . . O 20
- 5 West Bend . . N 18
- 4 West De Pere . . O 14
- 3 Whitefish Bay . . P 20
- 3 Whitewater . . M 21
- 9 Wisconsin Rapids . . I 14



RAND MCNALLY
POPULAR MAP OF
WISCONSIN

SCALE 1:2,154,000
1 inch = 84 Statute Miles
1 Centimeter = 21.5 Kilometers
Statute Miles 0 10 20
Kilometers 0 10 20
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branded as "peculiar." He asserted that he favored a continuance of the Union, that nothing could ever extinguish his affection for the Union, but that the coercive policy of the national government towards the seceding states made Virginia's secession necessary, and he voted for secession. Appointed a brigadier-general in the Confederate Army, he fought with distinction in numerous battles and campaigns throughout the war. In 1866 he resumed the practice of law in Richmond, Va., where he died Sept. 12, 1876.

BIBLIOGRAPHY.—B. H. Wise, *Life of Henry A. Wise*, 1899.

WISE, ISAAC MAYER (1819-1900), American rabbi, educator and author, was educated abroad. He came to the United States in 1846, after serving as rabbi in Bohemia for two years. In 1846 he was elected rabbi of the Albany synagogue, and introduced reforms there. In 1854 he was elected rabbi of the Bene Yeshurun congregation in Cincinnati and remained its spiritual leader until his death. In 1854 he founded and edited *The American Israelite*, and a German companion paper, *Die Deborah*. A profound believer in organization, Wise was at first inclined to check individualism and radicalism.

Wise was an ardent champion of Americanism, and from the time of his arrival in the United States realized that the development of Judaism in America was bound up with the use of the English language in the pulpit, and the training of American rabbis. He therefore founded the Union of American Hebrew Congregations in 1873, which was instrumental in establishing the Hebrew Union College in 1875, an institution for the training of rabbis. In 1889 Wise organized the Central Conference of American Rabbis, over which he presided until his death. It is made up of Reform rabbis in America and elsewhere. Active in all public affairs, Wise was the leading force in the organization of American Reform Judaism, and he was idolized by his pupils, and Jewish congregations of the West, Middle West and South. He was a leading influence in the preparation of an American Jewish prayer-book about 1855, called *Minhag America*, which was abandoned with his approval in favor of the Union Prayer Book published by the Central Conference of American Rabbis in 1894. A prolific writer, he in addition to editing his newspapers, published a number of religious and Jewish historical works as well as Jewish novels. In his memory, a \$5,000,000 endowment fund was established for the Hebrew Union College. M. J. K.

BIBLIOGRAPHY.—David Philipson and Louis Grossman, *Life and Selected Writings*, 1900; I. M. Wise, *Reminiscences*, 1901; Max B. May, *Isaac Mayer Wise*, 1916.

WISE, STEPHEN SAMUEL (1872-), American rabbi and orator, was born at Budapest, Hungary, Mar. 17, 1872. His education was received at the College of the City of New York and at Columbia University. From 1893 to 1900 he was Rabbi of the Madison Avenue Synagogue in New York, and from 1900 he was Rabbi of the Beth Israel Synagogue in Portland, Ore. While in Oregon he founded the

State Conference of Charities and Corrections. Returning to New York in 1907, he established and became Rabbi of the Free Synagogue of New York. Rabbi Wise was the founder and the first secretary of the Federation of American Zionists, and the founder and president of the Jewish Institute of Religion. In 1919 he was made Chevalier of the Legion of Honor. He is the editor and English translator of the *Ethics* of Solomon Ibn Gabirol, 1901, author of *How to Face Life*, 1917, *Child Versus Parent*, 1922, and of numerous contributions to various periodicals.

WISHBONE BUSH (*Mirabilis laevis*), a low, bushy, somewhat woody perennial of the four-o'clock family native to the Colorado and Mohave deserts and adjacent arid districts in California. It grows about a foot high bearing small, oblong, roughish leaves and showy reddish flowers mostly in terminal clusters.

WISHOSKAN, a North American Indian linguistic stock represented by a single tribe, the Wishosk or Wiyot.

WISHRAM, one of the dialectic sub-groups of the upper division of the North American Indian Chinookan linguistic stock, and the principal fishing village of one of its groups, the Tlakluit, on the Columbia River about five miles above the Dalles, Wash.

WISMAR, a city of the German state of Mecklenburg-Schwerin, on the Baltic Sea about 60 mi. northeast of Hamburg. It is a seaport and commercial city. It became a Hanseatic city in the 13th century. There are three churches of the 14th and 15th centuries, fine old Gothic buildings and the former ducal palace dating from the 16th century. Wismar's many industries produce agricultural machines, wire netting, paper, paper goods, mattresses, asphalt and cement, and the town has transit trade in Swedish lumber, stone, coal and grain. Pop. 1925, 26,016.

WISSLER, CLARK (1870-), American anthropologist, was born in Wayne Co., Ind., Sept. 17, 1870. In 1897 he was graduated from the University of Indiana and in 1901 received his doctorate from Columbia University. During 1901-02 he was instructor in education in New York University. From 1903 to 1905 he was assistant in anthropology, and from 1905 to 1909 lecturer on that subject at Columbia University. During 1903-06 he was assistant in anthropology, becoming curator in the latter year of the American Museum of Natural History, New York City. In 1924 he was appointed professor of anthropology at Yale University. He is the author of *The North American Indians of the Plains*, *The American Indian, Man and Culture*, *The Relation of Nature to Man in Aboriginal America*, and *Social Anthropology*.

WISTER, OWEN (1860-), American author, was born at Philadelphia, Pa., July 14, 1860. He was educated at Harvard and admitted to the Philadelphia bar in 1889. Wister's novels, *The Virginian*, 1902 and *Lady Baltimore*, 1906, were extremely successful. He also wrote a considerable amount of non-fiction,

and in particular his *Roosevelt*, 1930, attracted wide attention. Wister romanticized the western cowboy and made him a memorable figure in his fiction.

WISTERIA, a genus of handsome woody vines of the pea family, extensively planted for covering porches and trellises. There are six species, four of which are found in eastern Asia and two in the southeastern United States. They are stout vines with trunks several inches in diameter, often attaining great age. The twining branches bear large pinnate leaves, pealike, blue, white, lilac or purplish flowers in drooping clusters and leathery, many-seeded pods. Those commonly cultivated include the American wisteria (*W. frutescens*), with lilac-purple flowers, the Japanese wisteria (*W. floribunda*), with white to rose-colored flowers, and the Chinese wisteria (*W. sinensis*), with blue-violet flowers.

WITCHCRAFT, the practice of casting a spell to bring evil on another. Witchcraft refers especially to the successive outbreaks of this belief from the 15th to the 18th centuries. The belief in witches dates from biblical times, and laws against the practice were enacted from Roman days onward. In the general sense the bewitchment results from a ceremony combined with curses, upon a lock of hair, an article of clothing belonging to the enemy, or from mere dire glances. (See *EVIL EYE*.) As the primitive mind regarded illness or misfortune as the effect of bewitchment by an enemy, a similar belief in folklore referred the illness of a child, the lameness of a horse or the failure of crops to a grudge exercised by an enemy.

Under the Christian tradition the power of witchcraft was obtained by contact with the devil. Legends arose of witches traveling through the air who had power to transform themselves into animals. Systematic trials for witchcraft flourished at different periods and thousands of those accused were put to death. A late occurrence of the delusion was that in Salem, Mass., at the close of the 17th century. Confessions of attendance by familiar spirits were often enforced. Witches were identified by floating if thrown on the water or by feeling no pain when pricked with pins. The charges were in accord with the beliefs of the day, inflamed by the propaganda of witch-hunters.

The system of belief was developed from *DEMONOLOGY* and popular lore, and disappeared with enlightenment. However, sporadic recurrences of similar charges called "hexing," the German name for witch, occurred in 1930 in a section of Pennsylvania where the belief survives, and led to a trial for murder. Other modified forms of belief in witch-like influences, hoodoo or voodoo for example, may be found in many countries. J. J.

WITCHES' MILK. See *CHILDREN, DISEASES OF: Injuries and Diseases of the Newborn*.

WITCHES' SABBATH, THE, in medieval legend, the annual convocation of witches held under Satan's leadership. The witches were supposed to ride to the sabbath on broomsticks, distaffs, or rakes, and there to feast together and celebrate fantastic orgies.

There were also the sabbaths of the worshippers of witchcraft, gatherings held on the night of Feb. 2, May Eve, Aug. 1, and at Hallowe'en. In Shakespeare's *MACBETH*, the Three Witches hold their sabbath around a pot that "boils and bubbles."

WITCH-HAZEL (*Hamamelis virginiana*), a stout shrub or sometimes a small tree of the witch-hazel family closely allied to the sweet gum. It grows usually in low rich soil or on rocky banks from Nova Scotia to Minnesota and southward to Georgia and Arkansas. Although the witch-hazel commonly grows from 5 to 12 ft. tall, it occasionally attains a height of 25 ft. The spreading, flexible branches bear hazel-like leaves, very unequal at the base, and bright yellow flowers produced in profuse clusters in mid-autumn mostly after the leaves have fallen. The fruit, a woody, nutlike capsule which matures during the following summer, bursts elastically when ripe forcibly projecting the seeds to a distance of several feet. The astringent bark and leaves are used medicinally.

WITENAGEMOT or WITAN, THE, was the informal council of the Anglo-Saxon kings of England. The institution was not strictly feudal in that it was not a council of tenants-in-chief of the king but of anyone he chose to summon and might include men bound to him by no feudal ties. It was usual for the king to include his bishops and sometimes his abbots, but no absolute rule prevailed. The Witán had no precise functions and might, on the king's request, act either as a council or a court. The Witán has sometimes been seen as the source of the British Parliament, but the source of this institution is more likely the Council of the Barons, brought in by the Norman Kings.

WITHER, GEORGE (1588-1667), English poet, was born at Bentworth, Hampshire, June 11, 1588. He went to Oxford and studied law. In 1642 he joined forces with Parliament against Charles I, and after the Restoration was imprisoned for his verse pamphlet, *Vox Vulgi*. Among his earlier works are *Mournful Elegies* and *Epithalamia*. His charming *Shepherd's Hunting*, 1615, contains a noted passage praising the art of poetry. The exquisite lyric, *Shall I, Wasting in Despair*, appears in the second edition of *Fidelia*. Wither's later, religious verse includes *Songs of the Old Testament* and *Emblems*. The poet died in London, May 2, 1667.

WITHERSPOON, JOHN (1723-94), American educator and clergyman, was born at Gifford, Scotland, February 5, 1723. Educated at the University of Edinburgh, he held several pastorates in Scotland before coming to the United States in 1768 to assume the presidency of Princeton College. At the outbreak of the American Revolution, he strongly supported the colonies, was a signer of the Declaration of Independence and the Articles of Confederation and a member of the Continental Congress. Upon resuming his post at Princeton, Witherspoon broadened the scope of training, developing it as a cultural school rather than as a school of theology. He died on his farm near Princeton Nov. 15, 1794.

WITNESS, in law, at trials, one whose statement is received as evidence for any purpose. The statement may be made under examination in court, or by deposition or by affidavit. In **CONVEYANCING**, a witness to an instrument is one who is present at the execution of it and subscribes it for the purpose of testifying to its authenticity. Subscribing witnesses are required also in the case of wills.

WITTE, SERGEI JULIEVITCH, COUNT (1849-1915), Russian statesman, was born July 29, 1849 at Tiflis. His father, of German extraction, was an official at Tiflis. His mother was the descendant of one of the oldest Russian noble families. Witte distinguished himself in the Russo-Turkish War by his superb management of the transportation of troops on the Odessa Railway. He held several high offices in the imperial railway department until he was appointed minister of communication in 1892 and shortly thereafter minister of finance. Witte invited foreign capital, inaugurated large plans for public works, railway building, harbor improvements, and the protection for industry. It was better and cheaper for Russia, he said, to import capital and develop her own resources than to import manufactures and to continue to be exclusively agricultural. He also set up a government monopoly for the sale of vodka to increase the revenues.

In 1903 he was removed from his ministry and made president of the committee of ministers. He opposed the aggressive policy of the Russian imperialists in the Far East, warning the czar that Russia was not ready for a war with Japan. Not till Siberia had been settled and the Siberian railroad double-tracked would Russia be in a position to back a vigorous program of expansion in the Far East. Despite this, the Russo-Japanese war was precipitated in 1904 with disastrous results to Russia. Witte was appointed one of the Russian peace delegation to Portsmouth in 1905, where he was successful in obtaining fairly reasonable terms.

Upon his return Witte found Russia in a state of revolution and persuaded the czar to make concessions, especially the October Manifesto, in which he promised a constitution and a duma or parliament. Witte was then made prime minister but he resigned in 1906. He died at Petrograd during the World War, on Mar. 15, 1915.

WITTENBERG COLLEGE, a coeducational institution at Springfield, O. It is a liberal arts college, controlled by the Lutheran Church, by whom it was founded in 1842. There are no denominational restrictions. The institution operates under productive funds which amounted in 1931 to \$1,585,196. The library contained 42,846 volumes. In 1930-31 there were 1,078 students and a faculty of 96, headed by Pres. Rees Edgar Tulloss.

WITWATERSRAND, UNIVERSITY OF THE, an institution at Johannesburg, Transvaal, South Africa, founded as a School of Mines in Kimberley in 1896. The school was transferred to Johannesburg, and in 1921 was incorporated as the University

of Witwatersrand. Instruction is given in arts, science, medicine, engineering, commerce, law and dentistry. The endowment fund is more than £220,000. The university is located on a site of 100 acres about a mile from the center of the town. In 1930 there were 1,325 full-time, and 283 part-time students, and a faculty of 36. The chancellor was H.R.H. Prince Arthur of Connaught; the principal, H. R. Raikes.

WIYOT or **WISHOSK**, a small North American Indian tribe, comprising also a single linguistic stock called Wishoskan. They occupied coastal California around Humboldt Bay, and a short distance into the interior. Their territory being covered with redwood forests, the Wiyot lived mainly directly on the coast or banks of the rivers flowing into the bay, depending on the products of the sea and the rivers for their subsistence, rather than on acorns like other Californians. Their unit of social organization was the village of rectangular gable-roofed houses. They made redwood canoes and twined basketry. The settlement of the vicinity of Humboldt Bay in the middle of the 19th century marked the end of Indian occupation. In the case of the Wiyot, the few survivors have been submerged in the white population.

WLOCLAWEK, a city in the Polish voievodship of Warsaw, approximately 100 mi. from the city of Warsaw, on the Vistula River and the Warsaw-Bydgoszcz Railroad. It is the seat of a Catholic bishop, and has a Gothic cathedral of the 14th century and an Episcopal palace of the 17th century. Wloclawek has a court of appeals, advanced schools and factories producing machines, cellulose, soap, candles, organs and rope. The trade is chiefly in grain and lumber. Pop. 1921, 40,281.

WOAD (*Isatis tinctoria*), a biennial herb of the mustard family formerly cultivated for the blue dye obtained from its leaves. It is a smooth erect plant, about 2 ft. high, bearing oblong or narrow leaves and numerous small yellow flowers. The use of woad as a dye dates from very ancient times. Pliny and Dioscorides refer to its employment in dyeing wool; Cæsar states that the Britons used it for staining their bodies.

WOBURN, a city in Middlesex Co., eastern Massachusetts, 10 mi. northwest of Boston, served by the Boston and Maine Railroad. It is an important leather-making center, and manufactures shoes, chemicals, edge tools, fertilizers, trucks and a multitude of other commodities. In 1929 its total products were valued approximately at \$15,000,000; the retail trade amounted to \$6,718,763. In the east village, Montvale, stands the house where CHARLES GOODYEAR was living when he discovered the process for the vulcanization of rubber in 1839.

Woburn was settled about 1639 and became a city in 1889. Pop. 1920, 16,574; 1930, 19,434; about one-quarter were foreign-born.

WODEN or **WODAN**, the Teutonic name for the Scandinavian ODIN, god of wisdom and war, chief of the northern gods. With his two brothers Ve

and Vili he created the world, which he ruled from his palace at Asgard as long as the Æsir were all-powerful. At Ragnarok the giants and gods of evil, led by Loki, brought an end to Woden's rule.

WOFFINGTON, MARGARET (PEG) (1720-60), Irish actress, was born at Dublin, Oct. 18, 1720. She appeared in a show booth at the age of nine, and three years later played Polly Peachum in a Dublin juvenile performance of *The Beggar's Opera*. She made her adult debut as Ophelia at Dublin in 1737, and first appeared at Covent Garden, London, in 1740, where she continued to appear before enthusiastic audiences until 1759. Charles Reade made her the central character in his novel, *Peg Woffington*, 1853. She died at Teddington, Mar. 28, 1760.

WOHLER, FRIEDRICH (1800-82), German chemist, was born at Eschersheim near Frankfurt-on-Main, July 31, 1800. He studied at Marburg and Heidelberg, and in 1825 taught at the Friedrich Werder Industrial School at Berlin, becoming professor of chemistry there in 1827. In 1836 he became professor of medicine at Göttingen and inspector of the pharmacies of Hanover. During 1827 and 1828 he discovered the metals aluminum, beryllium and yttrium and in 1828 synthesized urea from inorganic nitrates, the first organic salt ever made artificially. He discovered isomerism (two salts with the same formula) and his work with Liebig on the benzoyl series laid the basis of the modern treatment of organic chemistry. His process of refining nickel made a large scale industry in that metal possible. He was considered also one of the ablest teachers of his time and his principal works *Foundation of Inorganic Chemistry*, 1831, and *Foundation of Organic Chemistry*, 1840, were of world influence. He died at Göttingen, Sept. 23, 1882.

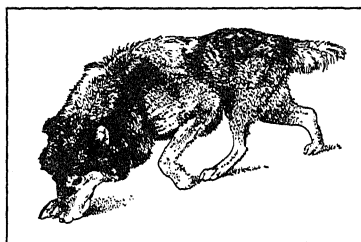
WOLCOTT, ROGER (1679-1767), American colonial governor, was born in Windsor, Conn., Jan. 4, 1679. At the age of twelve he worked as an apprentice in a weaver's shop, at twenty-one Wolcott established his own business. He served in several military campaigns including the Louisburg expedition in 1745 as a major general. Later he became a judge of the supreme court of Connecticut, served for a time as deputy governor, and was governor in 1750-54. He kept a journal of the Louisburg expedition which was later published by the Connecticut Historical Society, and wrote *A Brief Account of the Agency of the Honorable John Winthrop in the Court of King Charles II A.D. 1662*, since printed in the *Collections of the Massachusetts Historical Society*. Wolcott died in East Windsor, Conn., May 17, 1767.

WOLF, FRIEDRICH AUGUST (1759-1824), German educator and classical scholar, was born at Haynrode, Prussia, Feb. 15, 1759. He was educated at the University of Göttingen and became professor of Philosophy at Halle in 1783. When the University of Halle was suppressed in 1807, he moved to Berlin. As an educational theorist, Wolf is famous for having introduced the idea of making the science of philology a distinct branch in a classical program of studies. He favored classical studies as "mental dis-

cipline" in opposition to the new educational theories of Locke and Rousseau. His most famous work, *Prolegomena in Homerun*, 1795, contained his celebrated attempt to prove Homer's epics the work of several authors. Wolf died at Marseilles, France, Aug. 8, 1824.

WOLF, HUGO (1860-1903), Austrian music composer, was born at Windischgraz, Mar. 13, 1860. After studying two years at the Vienna Conservatory he made a meager livelihood as a music teacher. In 1881 he was appointed second conductor at the Salzburg Opera but renounced the work as uncongenial. Three years later he accepted a position as musical critic on the *Salonblatt*. There his prejudiced and bitter views, especially of BRAHMS, served to estrange many musicians of the period. His genius as a song composer was too great, however, to be disputed, and within a few years after his death that supervened upon insanity his lyrical contribution to the world was ranked with the *lieder* of the foremost German masters of all epochs. His single opera *Der Corregidor* was unsuccessful, but his songs, more than 250 in number, bear the mark of unquestionable greatness. He died at Vienna, Feb. 22, 1903.

WOLF, the largest and most powerful wild member of the dog family (*Canidae*). Wolves are found in most northern countries but not in the tropics, and are much alike everywhere. American wolves have been divided by naturalists into several species, but only three main types need be considered here, namely, the arctic, gray, and prairie wolves. The

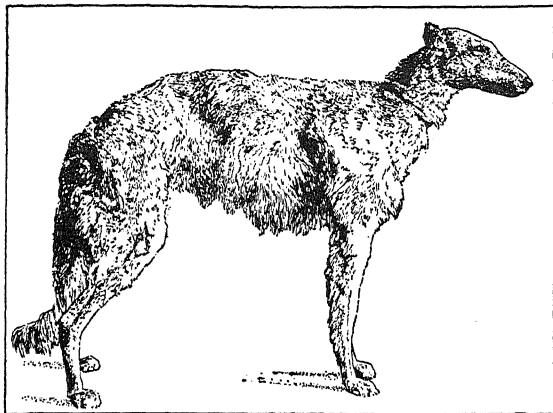


GRAY OR TIMBER WOLF

arctic, or tundra, wolf is greatest in size, 28 in. tall, cream-white, and confined to the circumpolar coasts. The gray, or timber, wolf, lobo or buffalo-runner (*Canis nubilus*) is the large animal once common all over most of the continent except at the arctic coast and islands, but now extinct in thickly settled parts. Its average size and weight are somewhat less than those of the arctic species; and its color is a grizzled gray inclining to reddish in southern and western forms. It is an animal of the forests, hunts in co-operative bands called "packs," preys on everything alive from mice to deer, and is destructive to cattle and sheep, but rarely has attacked human beings. In all its habits, as in its structure, it is virtually the same as the storied wolf of Europe and Asia. The animal often called prairie wolf is more correctly the COYOTE.

WOLF DOGS, two special breeds capable of overtaking and killing wild wolves. The strong, swift

Irish wolfhound, now used as an all-around sporting dog, can break the back of a wolf in its powerful jaws; it also is sometimes used on wild boar. This tallest of all dogs is gentle by nature. The Russian wolf-



RUSSIAN WOLFHOUND, OR BORZOI

hound or borzoi is far more slender, very fleet and much stronger than its build would indicate. Aristocrats of the dog world, the borzoi have uncertain tempers, especially to strangers.

WOLFE, JAMES (1727-59), English general, was born at Westerham, Kent, Jan. 2, 1727. He was educated at Westerham and Greenwich, and entered the army in 1742. In 1758 he commanded a brigade under command of Amherst in the attack on Cape Breton and Quebec. He was given command of a new expedition against Quebec in 1759. Arriving the last week in June, he made an unsuccessful attack July 31. On Sept. 13 he drifted up river with the tide, gained the Heights of Abraham and defeated the French by means of a surprise attack from above the city. Quebec surrendered five days later, but Wolfe himself died at Quebec Sept. 13, 1759, from wounds received during the battle. Wolfe's victory at Quebec brought to an end the long struggle for Colonial supremacy in North America and settled definitely the question of whether its institutions should be English or French.

WOLFF-FERRARI, ERMANN (1876-), Italian music composer, was born at Venice, Jan. 12, 1876. During 1893-96 he was a pupil of Rheinberger at Munich. He directed the Liceo Benedetto Marcello at Venice in 1902-09, retiring to devote himself to composition. His famous opera, *The Secret of Suzanne*, became popular at the Metropolitan Opera, New York, through the interpretation of Geraldine Farrar and Frances Alda. *Le Donne Curiose* was first produced at Munich in 1903, *The Jewels of the Madonna* at Charlottenburg in 1911, *L'Amore medico* in 1913, and *Sly* in 1927. His opera *La Vedova Scaltra*, based on one of Goldoni's comedies, was scheduled for production at Rome in 1931.

WOLFRAMITE, a widely distributed mineral, the chief ORE of tungsten. It is dark gray to brown or black, with an almost metallic appearance. Wolfram-

ite is the tungstate of iron and manganese, crystallizing in the MONOCLINIC SYSTEM. The common occurrence is in PEGMATITES and veins associated with tin ores, SCHEELITE, PYRITE, GALENA and SPHALERITE. PLACERS are the chief source of wolframite, as in China, Siam and Bolivia. It is mined from veins in South Dakota. Tungsten is used in incandescent lamps and tool steels. See also SCHEELITE; ORE DEPOSITS.

WOLFRAM VON ESCHENBACH (c. 1165-c. 1220), Middle High German poet, was born at Eschenbach, near Ausbach, Bavaria, about 1165. He was of noble birth and knew French, but tells us that he could neither read nor write. He was a frequent visitor at the court of Hermann, Landgrave of Thuringia, a well-known patron of poets, and is supposed to have taken part in the Wartburg contests. He is noted for three epic poems which rank him among greatest of medieval German poets. *Parzival*, the greatest court epic of Germany, was based on French sources of Celtic origin dealing with the HOLY GRAIL, and chiefly on a poem by CHRETIEN DE TROYES. *Titarel*, an unfinished poem composed about 1210, was based on similar sources; and *Willehalm*, about 1216, also unfinished, was based on French national poetry. Wolfram died about 1220 and was buried in the Frauenkirche at Eisenbach. See also ARTHURIAN LEGENDS; GERMAN LITERATURE; PARSIFAL.

WOLFSBANE, a common name given, especially in England, to the monkshood, a low perennial species of ACONITE yielding a powerful poisonous drug.

WOLSEY, THOMAS (1475?-1530), English churchman and statesman, was born at Ipswich sometime between 1471 and 1475. He was educated at Magdalen College, Oxford. In 1500 he became rector of Lymington, Somerset, and was then made successively chaplain to the archbishop of Canterbury, Sir Richard Nanfan, and Henry VII. Practical, capable and ambitious, he received continuous advancement under Henry VII, who consulted him in both domestic and foreign affairs. In 1511 he was made canon of Windsor and a privy councillor and after military service in France in 1513 was advanced to the bishopric of Lincoln and the archbishopric of York. At 40 years of age he received the cardinalate and was made Lord Chancellor and Prime Minister, possessing thereby the highest office in both the temporal and spiritual affairs of England. Wolsey was an adroit statesman, continually arranging treaties he thought to be for the benefit of England's trade, and to maintain peace, to secure the Scottish union and to effect judicious church reforms. He loved luxury and ostentation. When he was made bishop of Durham, he did not resign the Archbishopric of York, which he held at the time. While there is some question as to how openly he aspired to the papacy, the facts seem to indicate that to be his ambition. He founded and endowed Christ's College, Oxford.

The change in his fortunes came because of his opposition to the annulment of the marriage of Henry VIII and Catherine of Aragon. This brought upon

his head the displeasure of Anne Boleyn, who plotted continually and, in the end, successfully, against him. He was stripped of all his honors and sent in disgrace to Esher. Though still retaining the friendship of the king, and finally restored to his property, he was ultimately arrested on a charge of high treason. Summoned to London to stand trial, he succumbed at Leicester Abbey, Nov. 29, 1530.

WOLVERENE (*Gulo luscus*), a large, heavy-set carnivore related to the weasels, called also carcajou and glutton. The wolverene is similar to the glutton of Europe, is a keen hunter, powerful enough to kill a deer when taken at a disadvantage, but subsists mainly on rabbits, skunks, ground-squirrels and grouse, and digs burrows for its family life. It is the pest of fur-trappers, seeking out and robbing their traps, at the same time avoiding their poison or snares with amazing ability. Wolverenes occur in the wilder sections of Canada and Alaska, but have been almost exterminated in the United States, a few still remaining in our western mountains.

WOLVERHAMPTON, a town of Staffordshire, England, situated in the heart of the midlands with extensive coal mines and beds of ironstone in the vicinity, 13 mi. northwest of Birmingham and 126 mi. northwest of London. It is a large industrial town with smelting works, and brass, tin, galvanized iron, lock and chemical manufactures. Among the imposing buildings is the collegiate Church of St. Peter, founded in 996 by Wulfrana, King Edgar's sister. It has been rebuilt, enlarged and restored several times, part of the design being by Pugin, and to-day remains a fine cruciform Gothic edifice, with a stone cross in the churchyard, a carved stone pulpit of 1480 and several monuments. It continued collegiate until 1846. The other public buildings are modern. Pop. (of county borough) 1921, 121,316; 1931, 133,190.

WOMAN'S CHRISTIAN TEMPERANCE

UNION, referred to as W.C.T.U., a reform organization formed in 1874 with the design of promoting temperance and suppressing the liquor traffic. The society now has a branch in every state and territory of the United States and a total membership above 600,000. In 1883, the "World's Woman's Christian Temperance Union" was organized through the efforts of Frances E. Willard and chapters are to be found in most of the civilized countries of the world. The American headquarters are in Evanston, Ill. Besides its temperance work, the society, which is highly organized and departmentalized, has obtained the passage of laws requiring the teaching of hygiene and physiology in the public schools with special emphasis on the effects of alcohol on the human system. Other interests of members include preventive sickness measures, and legislative, social, and evangelistic work, stressing in particular the rights of women. A total abstinence pledge must be signed by each member. The society's motto is, "Do Everything," and the badge, a bow of white ribbon. Two official publications are the "Union Signal" and "The Young Crusader."

WOMAN'S MOVEMENT, THE, has been the determined effort of women to obtain equal rights with men. As early as 1638 Anne Hutchinson was excommunicated and banished from the colony of Massachusetts because "with the impudent boldness of a proud dame" she had criticised men in authority and had herself dared to preach. During the French Revolution the inferiority of women began to be questioned, especially by Condorcet, while in England in 1792 Mary Wollstonecraft published a book entitled *Vindication of the Rights of Women*. In this she was radical enough to advocate for them education, economic independence and even enfranchisement.

Until the 19th century, however, the position of woman remained practically unchanged from what it had been for centuries, though occasionally one ventured to engage in some small business or was bookish enough to be called a blue-stocking. Divine Providence was supposed to have predestined her for the bearing and rearing of children and to have limited her activities to the home. Economically and legally she was a dependent. Her husband had the right to administer even physical punishment, controlled her property and was the sole guardian of her children. The Rev. J. N. Danforth of Boston expressed the popular opinion of his day when he wrote in 1844, "Home is the palace of the husband and the father. He is the monarch of that little empire, wearing a crown that is the gift of Heaven, swaying a sceptre put into his hands by the Father of all, acknowledging no superior, fearing no rival, and dreading no usurper."

The day of the emancipation of women dawned with the industrial revolution, when the factory offered a means of subsistence outside the home. With this as a beginning other occupations soon opened to them, though mainly in semi-skilled lines. Teaching long remained the only profession in which they had the sanction of public approval, but they were able slowly to gain a foothold in law, medicine, literary pursuits and other fields.

Though a few of the older European Universities, notably Padua, had admitted an occasional woman, educational opportunities had rarely been available until a pressing demand for them arose as a means of training for earning a livelihood. If a woman was to teach, her right to an education had to be recognized. The first woman's seminary of College rank, Mt. Holyoke, was opened by Mary Lyon in 1836 and Vassar College was founded in 1861. Meanwhile, co-education had been making some headway, for Oberlin College, founded in 1833, admitted both men and women, as did the University of Iowa in 1855. England was slower in providing for the higher education of women. Girton Hall at Cambridge University was not opened for them until 1873, Newnham Hall, in 1875, and Lady Margaret Hall at Oxford, in 1878.

Political Rights. The demand of American women for equal legal and political rights was closely

associated with an earnest zeal for humanitarian reforms, especially for the abolition of slavery. Thus the Scotchwoman, Frances Wright, who first visited America in 1820, the Grimké sisters of South Carolina, Dorothea Dix, who agitated for better care of the insane, Lucretia Mott, Elizabeth Cady Stanton and Susan B. Anthony, were ardent advocates of freedom for all who were oppressed. Under such leadership the first woman's rights convention in the world was held at Seneca Falls, N.Y., in 1848.

Following the inspiring example of Florence Nightingale in the Crimea, American women did noble work during the Civil War, especially through the Sanitary Commission and the Ladies' Christian Commission. The Woman's Christian Temperance Union founded by Frances Willard in 1874, soon became large and influential. The Woman's Club movement, started about the same time, became effective in teaching the value of organization, while the National American Woman Suffrage Association and similar groups had the one definite purpose in view.

Slowly but inevitably the legal status of women improved. Beginning with Mississippi, various states granted married women the control of their own property. In every state the wife acquired the right to dispose of her separate property by will and in most of them, to control her own earnings. By 1900 nine states had given mothers the equal guardianship of children, though this was not done in England until 1925.

Kansas granted women the right to vote in school elections in 1861, an example followed by many other states, but Wyoming in 1890 was the first to grant complete equality in the franchise. As the number of women voters increased and leaders like Mrs. Carrie Chapman Catt followed more determined methods, greater pressure was brought to bear upon Congress, until in 1920 the 19th Amendment to the Constitution gave the franchise to women.

This action was undoubtedly hastened by the important part played by women during the World War. In order to co-ordinate patriotic activities the National Woman's Committee was organized with Dr. Anna Howard Shaw at its head. Branches were established in every state and so far as possible in every county and city. Thousands of women served abroad with the Expeditionary Forces, those at home worked in the Red Cross, in munition factories, in the civil service and even at farm labor, while housewives contributed much through their conservation of food.

Meanwhile women had been enfranchised in New Zealand in 1893 and in Australia in 1902. The first European country to do this was Norway, partially in 1907 and fully in 1913. Denmark followed in 1915. In England, John Stuart Mill introduced an amendment to the Reform Bill of 1867 that would have provided enfranchisement for women. This was ridiculed and defeated, but two years later he published his powerful book, *Subjection of Women*.

Long agitation proved so fruitless that early in the 20th century Mrs. Emmeline Pankhurst and her

daughters organized the "Suffragettes" who for a decade kept the question before the public by their militant methods. Not until 1914 did their outrages stop. Then women entered so whole-heartedly into the task of winning the war that Lloyd-George decided to give a large proportion of them the suffrage in 1918. Their complete enfranchisement was granted them by Stanley Baldwin and the Conservative Party in 1928.

The new constitutions of Russia, Germany and other central European countries drawn up after 1918 contained provisions for universal and equal suffrage. The Latin countries on the other hand rather held aloof from this movement until Spain, after the Revolution of 1931, incorporated the franchise for women in its new republican constitution. A. L. L.

BIBLIOGRAPHY.—E. C. Stanton et al., *The History of Woman Suffrage*, 4 vols., 1889-1902; A. M. Schlesinger, *New Viewpoints in American History*, 1922; Kaethe Schirneacher, *The Modern Woman's Rights Movement*, 1912; J. Langdon-Davies, *A Short History of Women*, 1927; Mary R. Beard, *On Understanding Women*, 1931.

WOMAN'S RIGHTS PARTY or NATIONAL EQUAL RIGHTS PARTY, the extension of an organization of political feminists in California, which in 1884 nominated Belva A. B. Lockwood, woman lawyer of Washington, D.C., for the presidency. The party did not survive the election of 1888.

WOMBAT (*Phascolymys mitchelli*), a terrestrial marsupial of southern Australia, called by Australians native bear. It is a heavily built, short-legged animal somewhat resembling a half-grown bear, and living in a burrow, whence it comes out at night to feed, shuffling about in search of roots, dragging them out with its powerful teeth. It also eats grass and herbage generally, stuffing its cheek-pouches with them. It breeds rapidly, is gentle and harmless in disposition; its skin enters largely into the fur-exports of Australia. A related species inhabits Tasmania. See KOALA.

WOMEN, EDUCATION OF. The provision of opportunities for the education of girls and women is relatively modern in the history of civilization. Such education as they received in ancient and medieval times was determined mainly by the status assigned to them from the social, economic and even religious points of view as wives and mothers. The very fact that history mentions many examples of women of outstanding intellectual training and ability, such as Aspasia, Sappho, Hypatia, Cornelia, Roswitha and Herrad, is evidence for the fact that they were outstanding because they were rare. While an educational regime was frequently prescribed in the medieval convents, it is very probable that it was intended only for novices and members of religious orders.

The desirability of educating girls and women in something more than the mere rudiments began to be urged during the Renaissance; but while the number of educated women, particularly in the upper classes, began to increase, they received their education generally from private tutors. Schools for girls

providing more than elementary education began to appear, especially in England and France, in the 17th century; but in general the emphasis was on practical arts: deportment, breeding and accomplishments, as in the school advertised by Mrs. Bathsua Makin in England, in 1673, or on religious and moral training as in the School at St. Cyr sponsored in France by Madame de Maintenon in 1686. From this time on academies for girls began to increase rapidly in these countries as well as in Germany.

England. The greatest stimulus to a reconsideration of the educational needs of women came from Fénelon's *De l'Education des Filles* published in 1687, from Rousseau, Defoe, and a host of women in England, including among others Lady Mary Wortley-Montagu, Mary Wollstonecraft and Hannah More, who succeeded in drawing attention to the subject despite the contempt of the 18th century to the blue-stockings. In England the movement for reform began with the desire to afford training for women who wished to teach. A society was established in 1846 to grant diplomas on the basis of an examination, and out of this there developed in 1848 Queen's College, London, with which Archbishop Trench, Charles Kingsley and Frederick Denison Maurice were associated. Bedford College followed in 1849, Girton College in 1869, and Newnham in 1870, at Cambridge, and Somerville Hall and Lady Margaret Hall at Oxford in 1879. Women trained in these institutions became leaders in the movement for the improvement of the education of girls and women; among them were Mary Frances Buss, Dorothea Beale, Emily Davies and Sophie Bryant. In 1862 girls were allowed to take the Cambridge local examinations. The Girls' Public Day School Company, founded in 1872, extended the opportunities for the education of girls, which were further increased in the last decade of the 19th century by public and semi-public schools. Under the Act of 1902, which permitted local authorities of a certain size to provide secondary education out of local taxes, the same opportunities were provided for girls as for boys.

COEDUCATION in principle is not popular in England; but a number of mixed schools exist. The important problem at present is to combine the opportunities already provided with the adequate differentiation to meet the needs for girls. The University of London threw its degrees open to women in 1878, Victoria University in 1880, Durham University in 1895, and all the local universities when chartered. Oxford admitted women as recognized students eligible for degrees in 1920; the right to degrees is still denied to women at Cambridge.

Germany. In Germany secondary education was with few exceptions provided in private or local schools in the first three-quarters of the 19th century; even when the state, e.g. Prussia, in 1874 and 1886, began to devote attention to the subject, girls were not provided with the same opportunities as boys. It was not until 1908 that a reorganization of secondary education took place and courses preparing girls for

university entrance were introduced; at the same time special courses preparing for entrance into women's careers were instituted. Since the creation of the Republic there has been some agitation for coeducation; but the practice is still to educate girls in separate schools. Admission of women to the German universities developed slowly, and until 1913 the southern states were more liberal than Prussia. To-day the opportunities are virtually the same for both sexes.

Private schools, convent schools and a few state regulated schools provided secondary education for girls until their general regulation by the law of Camille Sée, 1880. From 1880 until 1923 the schools provided a general modern education, leading to a diploma; in 1923 there were added courses leading to the *baccalauréat* and so to the universities.

The United States. The education of girls in the American colonies was very meager; it was not until after the Revolution that the establishment of private academies created opportunities for them, but even then mainly for an education in accomplishments. Largely through the efforts of women like Emma Willard, Catherine Beecher, Z. P. Grant and MARY LYON more serious provision began to be made from about 1825 on both for secondary and higher education of girls and women. Colleges for women began to be founded in all parts of the country after 1830: ELMIRA COLLEGE, 1855; VASSAR COLLEGE, 1860; WELLESLEY COLLEGE, 1870; MOUNT HOLYOKE COLLEGE, 1888. Beginning in the '20s coeducation spread rapidly, and after the middle of the century became the rule except in some larger cities in the East. The problem of equality of opportunity was thus solved both at the secondary and the higher levels. Thus OBERLIN COLLEGE admitted women from its start in 1833; ANTIOCH COLLEGE in 1853; of the state universities many admitted women from their opening, while others admitted them subsequently. The admission of women to institutions for professional training was slower and did not become general until the present century. The problems confronting the education of girls and women at present are concerned not so much with equality of opportunity as with the provision of differentiated types of education which will enable them to take their place in the home and in vocational careers, with a preparation adequate for the new responsibilities which women have assumed as voting citizens. I. L. K.

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WOMEN, OCCUPATIONS AND STATUS.

Before the existence of factories, every home was a small manufacturing plant in which the housewife was the manager and sometimes the only laborer. As a rule, she was helped by daughters and granddaughters and in rich families by servants or slaves whose numbers might mount into the hundred. Their duties were to spin and weave the cloth used by the whole establishment; make the garments; cure the

meats; make soap and candles; and even brew the medicines.

Women's duties were at home unless they went out for teaching, dressmaking or domestic service. This condition lasted until the opening of the first cotton mills early in the 19th century. When the Civil War brought a labor shortage, more trades were opened to women and the World War completed the process. Now 22% of the total number in industry are women. They work in 232 occupations and predominate in seven. They have, every year, a larger percentage in the skilled occupations and in the professions. On an average, women's wages are lower than those of men and therefore there are 250,000 women in the United States organized in trade unions and working for better wages and better working conditions.

American women began to work for the vote in 1848 and it was finally granted in the 19th Amendment passed in 1919, during the World War. Women are now eligible not only for the vote but for any political office. In 1931 there had been in America 12 women mayors, 2 governors, 127 state legislators, 6 secretaries of state, 13 Congresswomen and several chiefs of Federal bureaus. Women take part in party conventions and, in some states, take full responsibility for organizing the women of the party.

For discussion of their own problems and for stimulating contact outside the home, American women are organized in a network of women's clubs, covering the whole country. These range from small study clubs to well-financed organizations with a club house, a paid secretary and an efficient program of study, social life and civic betterment. There are 34 national organizations of such clubs, banded together in the National Council of the Women of the United States and having affiliations with similar national councils in 41 other countries.

In spite of woman's changed status, housewifery is still the predominant occupation. The Bureau of Home Economics estimates the time each one spends on her tasks as about 48 hours a week. There are two reasons for these long hours. The housewife no longer has help from young children and unmarried daughters, the former being at school and the latter often at work. Also, while the housewife has given up many of her more primitive tasks, she has assumed new responsibilities in the scientific feeding and care of her family and the psychological training of her children, problems scarcely considered 100 years ago.

There are fewer children born (*see BIRTH RATE*) to any one mother than in former years. However, better care for each child, beginning even before its birth, has so reduced the *DEATH RATE* that more children live to maturity than formerly. A mother can obtain expert advice and assistance in her problems from prenatal clinics, child clinics, nursery schools, child psychologists, playgrounds, parent-teacher associations and similar organizations. R. M. U.

WOMEN IN INDUSTRY. During the earlier stages of economic development, women were pri-

marily used in production, since men were largely occupied with warfare and the chase. In the handicraft stage, although manufacturing centered around men, women had some part. With the introduction of power machinery, their employment greatly increased. Production was shifted from the home to the factory and women left their homes and entered the labor market in competition with men.

Except in those occupations for which they are physically unqualified and from which they have been excluded in the interest of social welfare, women are becoming an increasingly important factor. The 1920 Census showed a total of approximately 8,203,000 women 16 years of age and over gainfully employed. One woman out of every four is employed. One in every five wage earners is a woman. They are employed in 532 occupations, all but 35 of the total number listed by the Census. About one-fifth of the women employed are in manufacturing and 11% are in agriculture. They make up a large part of the staff in offices of banking, insurance and real estate firms. Large numbers are employed in wholesale and retail trade, in professional and domestic service and in transportation. Nearly one-fourth of the women employed in 1920 were married. Forty per cent of the employed women were not more than 25 years old.

Women are, with startlingly few exceptions, earning appreciably lower wages than men doing the same work, often one-third to one-fourth or even 50% less when output is the same. As a result, women often enter into competition with men, thus depressing the wage standards of male workers. It is mainly for this reason that organized labor has opposed their employment. Recently there has been much agitation for equal pay for equal work.

The movement for legal protection of women workers was contemporaneous with that of child workers (*see CHILD LABOR*), in many cases the laws regarding hours and night work applying to both groups. In 1931 all the states except four had definitely forbidden employment of women for more than a certain number of hours each week, or required that all employment beyond a specified number of hours shall be paid at an increased rate. The legal working week ranges from 48 hours to 60 hours depending upon the industry and the occupation. In the same year night work in certain occupations and industries was prohibited in 16 states and about one-fourth of the states had laws prohibiting or regulating home work. Laws establishing a minimum wage for women, passed by several states, were declared unconstitutional by the United States Supreme Court and although enforcement in some states has continued it has been largely through the cooperation of progressive employers. Other laws regulate physical conditions of employment and prohibit employment in occupations injurious to health.

Legal restrictions upon the employment of women have been attacked on a number of grounds. It is now generally conceded, however, that the state has

a right under the police power to limit woman's theoretical freedom because the vitality of the race depends so largely upon her health. M. G.

BIBLIOGRAPHY.—Joseph A. Hill, *Women in Gainful Occupations, 1870-1920*, Washington, 1929; U. S. Women's Bureau, *Publications*.

WOMEN'S SUFFRAGE. See WOMAN'S MOVEMENT, THE.

WOOD, LEONARD (1860-1927), American soldier, was born at Winchester, N.H., on Oct. 9, 1860. Graduating in medicine from Harvard University in 1884, he joined the United States army as assistant surgeon in 1885. His participation in the campaign against the apache Indians in the Southwest gained for him the rank of first lieutenant and the Congressional Medal of Honor. He was appointed captain in 1891. When the war with Spain was declared, Wood became colonel of the Rough Riders with THEODORE ROOSEVELT his second in command. Through the showing of his command at Guasimas and San Juan he became a major-general of volunteer troops.

While military government was in force in Cuba in 1899-1902 Wood as governor-general performed a notable service in improving the health and sanitary conditions of Havana. From 1903-08 he was governor of the Moro province in the Philippines, and from 1908-10 and from 1914-17 was commander of the Eastern Department. He was chief of staff from 1910-14, and during the war period had charge of the preparation of recruits for overseas duty. In 1919 he headed the Central department. The following year he was a leading candidate for the Presidential nomination, but was defeated in the Republican National Convention by WARREN HARDING. Appointed head of the Wood-Forbes commission to the Philippines and shortly afterward in 1921 president of the University of Pennsylvania, Wood never took the latter office, remaining instead in the Orient as governor-general of the Philippines. Although his time of office was filled with much agitation in the islands for independence Wood's governorship was highly successful. His health undermined by climatic conditions and official responsibilities, Wood returned to the United States in 1927 to recuperate. He died on Aug. 7, 1927.

Wood published *Our Military History, Its Facts and Fallacies*, 1916; *Universal Military Training*, 1917; and *America's Duty as Shown by Our Military History*, 1921. He was the originator, as part of the preparedness program which he advocated, of the Citizens' Military Training Camp movement, and was largely responsible for the first camp at Plattsburg, N.Y., which led to the establishment of many others during and after the World War.

WOOD, ROBERT WILLIAMS (1868-), American physicist, was born at Concord, Mass., May 2, 1868. He studied at Harvard and Johns Hopkins universities and at the University of Berlin, in 1897 becoming professor of physics at the University of Wisconsin and in 1901 professor of experimental physics at Johns Hopkins. He made researches into

the optical properties of metallic vapors and developed a method of color photography by light diffraction.

WOOD, THOMAS DENISON (1865-), American educator, was born at Sycamore, Ill., Aug. 2, 1865. He graduated from Oberlin College in 1888 and from the College of Physicians and Surgeons, Columbia, in 1891. Wood became professor of physical education at Columbia in 1903, and retained that post until 1927 when he became professor of health education. He became vice-president of the American Child Health Association in 1922, and in 1929, as a committee chairman, participated in the White House Conference on Child Health and Protection. In 1931 he was made professor emeritus of Columbia University.

WOODBERRY, GEORGE EDWARD (1855-1930), American literary critic, was born at Beverly, Mass., May 12, 1855. He was Professor of English at the University of Nebraska, and from 1891-1904 Professor of Comparative Literature at Columbia University, New York City. He wrote extensively on literary subjects and his biographies of Hawthorne and Poe are especially noteworthy. In 1907 Woodberry published *The Appreciation of Literature*, perhaps his best known work. He died Jan. 3, 1930.

WOODBINE, a name properly given to an Old World HONEYSUCKLE (*Lonicera Periclymenum*), long cultivated as an ornamental shrub. In various parts of the United States, especially in New England, the VIRGINIA CREEPER is called woodbine.

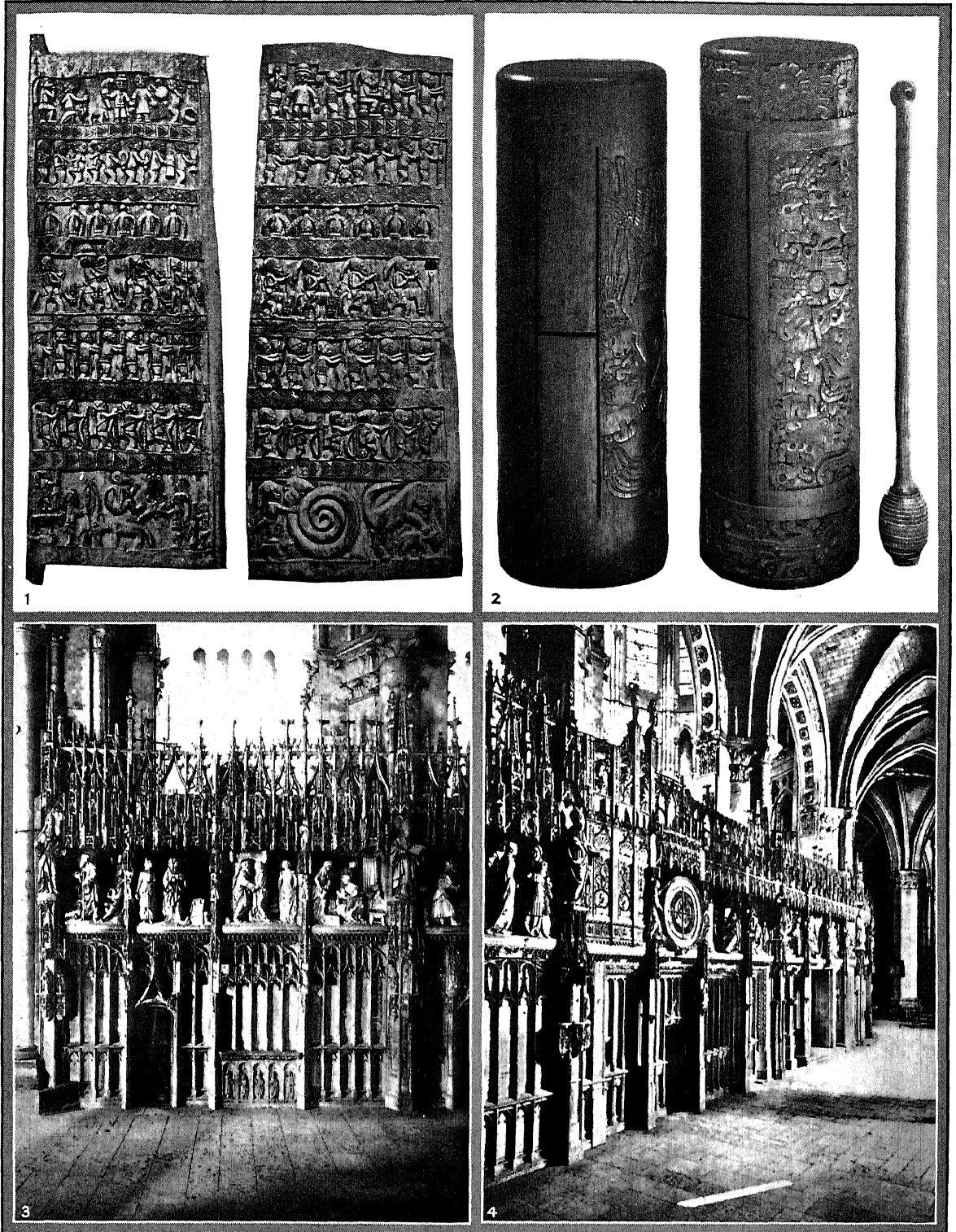
WOOD BLOCK PAVEMENTS have a surface layer of wooden block laid by hand as for a BRICK PAVEMENT. The blocks are generally three to four inches wide, five to nine inches long and three and a half inches deep, laid with the grain vertical. They are cut from seasoned yellow pine or fir timbers, and receive treatment by which eight to 15 pounds of a mixture of TAR and CREOSOTE oil are forced into a cubic foot of the wood as a preservative. Blocks are set in a cushion of sand or mastic, or on a paint coat of tar or asphalt placed on the PAVEMENT BASE. The joints are then filled with bitumen. Now little used for street pavements, they make good factory floors.

W. W. H.

WOODBURGE, a township of east central New Jersey, in Middlesex Co., served by 3 railroads, and bus and traction lines, 24 mi. southwest of New York City. Clay and sand pits are nearby, and local manufactures are chiefly bricks and ceramics. Pop. 1920, 13,423; 1930, 25,266.

WOODBURY, LEVI (1789-1851), American political leader, was born in Franconstown, N.H., Dec. 22, 1789. He graduated from Dartmouth College in 1809 and studied law in Litchfield, Conn., Boston, Mass., and Exeter, N.H. He was admitted to the New Hampshire bar in 1812, practicing in Franconstown 1813-16. He was appointed judge of the Superior Court of New Hampshire in 1816. After moving to Portsmouth, N.H., in 1819 he was governor of New Hampshire 1823-24 and speaker of the State House of Representatives, 1825. He was elected as a Demo-

WOODCARVING

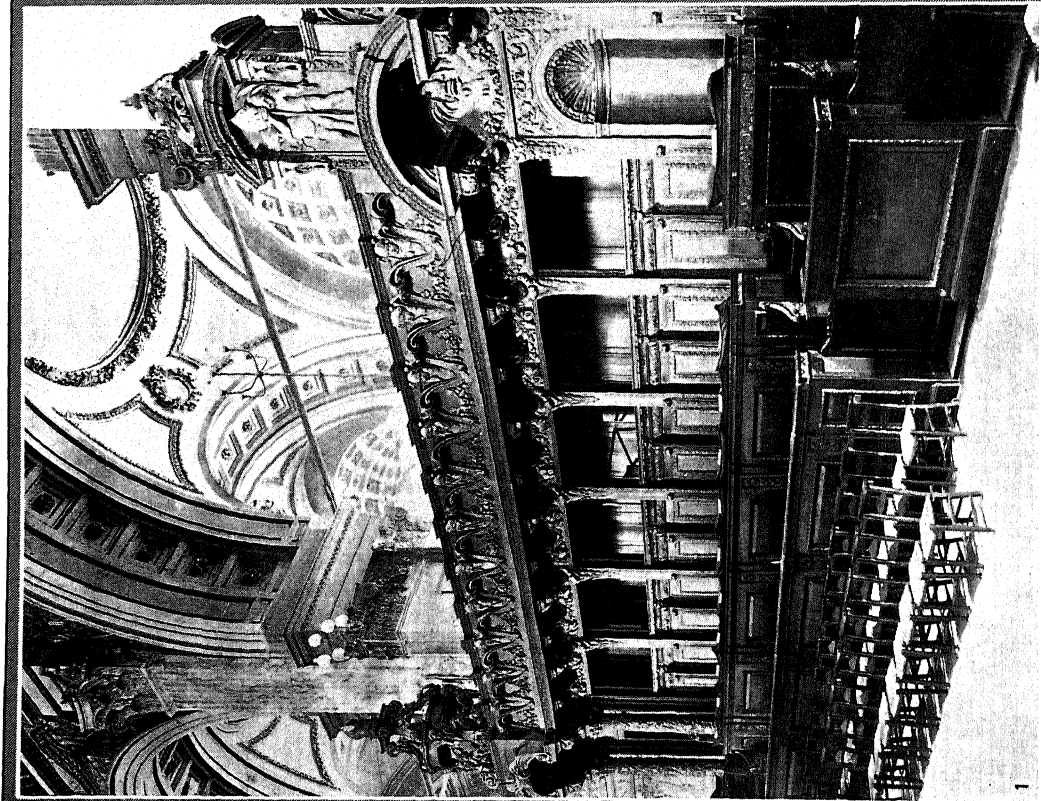


1, 2. COURTESY AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK

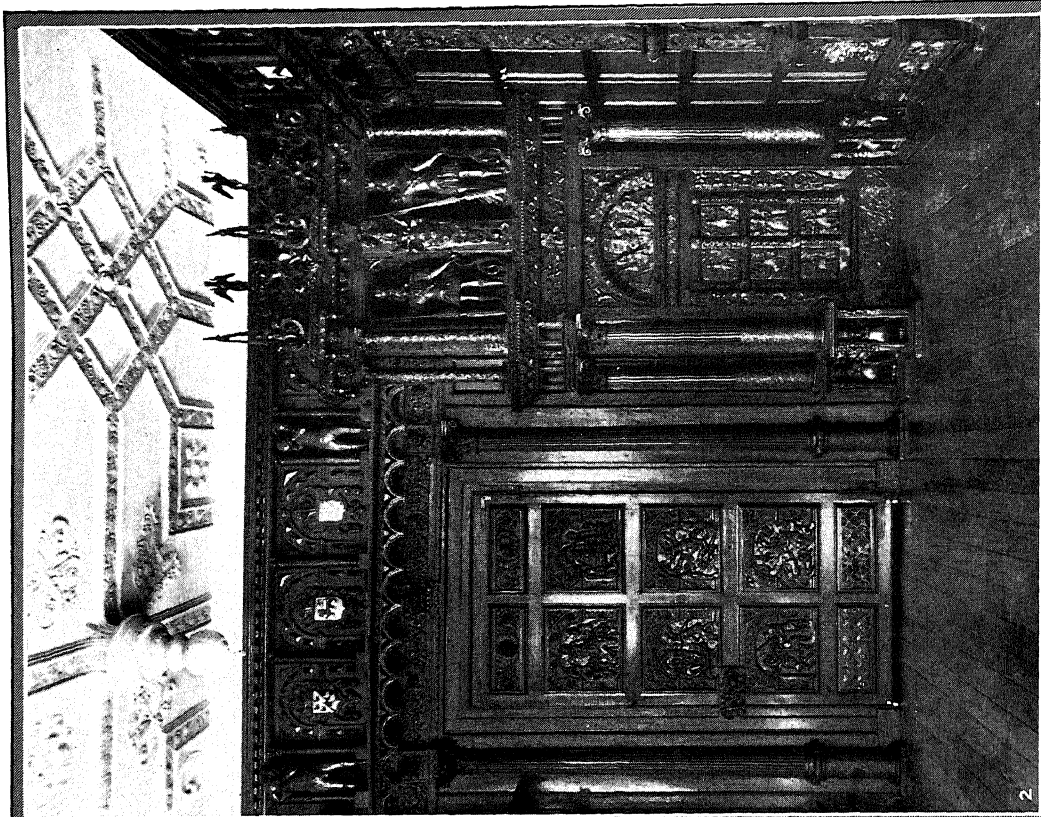
PRIMITIVE WOODCARVING AND LATE RENAISSANCE STONE CARVING

1. Carved wooden doors from northern Nigeria, Africa. 2. Maya drums of Mexico. 3. A 16th century choir screen, Cathedral of Chartres, France. 4. South side of the ambulatory in Chartres Cathedral, showing the choir screen.

WOODCARVING



1. Throne and stalls in St. Paul's Cathedral, London.



2. Complex of beautiful detail in an English country house. Late Gothic door panels combined with Renaissance carving in an English country house of Devonshire.

NOTABLE ENGLISH WOODCARVING

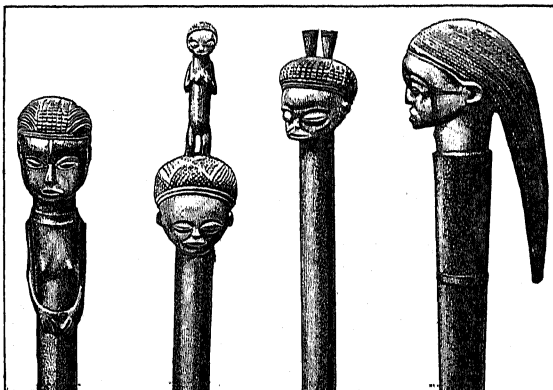
1. Throne and stalls in St. Paul's Cathedral, London. Carved decoration by Grinling Gibbons (1648-1720). 2. Complex of beautiful detail in an English country house. Late Gothic door panels combined with Renaissance carving in an English country house of Devonshire.

2. COURTESY CHARLES OF LONDON, NEW YORK CITY

crat for one term to the U.S. Senate, 1825-31. A loyal supporter of Andrew JACKSON, Woodbury was appointed by him Secretary of the Navy, 1831-34 and from 1834 to 1841, he was Secretary of the Treasury. As Secretary of the Treasury, he installed the sub-treasury system in 1840 and upon his reelection to the Senate in 1841 he was a leading apologist for that method of handling the government funds. In 1845 he declined the British mission but the same year he resigned from the Senate to accept an appointment as Associate Justice of the U.S. Supreme Court in which he served until his death at Portsmouth, N.H., Sept. 4, 1851.

WOODBURY, a city and the county seat of Gloucester Co., N.J., situated 9 mi. south of Philadelphia, Pa., on the navigable Woodbury River and the Pennsylvania Railroad. It is the trading center for a prosperous fruit-growing and truck-gardening area and has a number of local industries including the manufacturing of trunks, pharmaceuticals and hosiery. The first settlement has been said to have been made about 1681. It was incorporated as a borough in 1851. During the Revolution Woodbury was the scene of considerable activity, being occupied alternately by the American and British troops. It was used as a headquarters by Cornwallis and the building which he occupied is still standing. Woodbury received its charter as a city Mar. 16, 1870. Pop. 1920, 5,801; 1930, 8,172.

WOOD CARVING, the art of sculpture in wood and of ornamenting objects made of wood by carving out a decorative design. The woods best suited to carving are limewood, oak, walnut and yellow pine. Mahogany, chestnut and fruit woods are used to a lesser extent. An outline of the proposed carving is first drawn on the wood; it is then roughly "bosted in" with gouges and chisels of various sizes and with variously shaped cutting edges. The skill of the carver is shown in the texture which he gives to the wood in the final finishing process. A glue which



CARVED KNOB-STICKS FROM BASUTOLAND, AFRICA

will join sections of carving permanently and unnoticeably is essential.

Wood carving has been practiced since prehistoric times and is a favorite among contemporary primitive

peoples as witnessed by the wooden gods, carved weapons, and utensils of the South Sea Islands and of Africa. Very few examples of Mayan wood carving have survived the climate and the years, but those which have show that the Mayas were as expert artisans in this medium as they were in stone. The "graven images" of the Old Testament were undoubtedly of wood. In Greek and Roman times carved wood was little used. It was revived in the 11th century and became one of the great arts of the Middle Ages and the Renaissance. Exquisitely and intricately carved building façades, screens and articles of furniture are common in China and in India. They are made from East-Indian cedar, sandalwood and teak.

Wood carvings designed by Raphael adorn the Vatican, and a richly ornamented wood cornice was carved by Michelangelo for the Farnese Palace. The Cathedral of Chartres is a leading example of the elaborately carved choir stalls, rood lofts, screens and canopies which are characteristic of Gothic churches. Grinling Gibbons who worked with Christopher Wren in the latter part of the 17th century is the world's most famous wood carver. His outstanding work is St. Paul's Cathedral in London.

WOODCHUCK (*Marmota monax*), an American marmot, called also groundhog. The woodchuck is a familiar, stout-bodied, grizzled, burrowing rodent of the North American fields and meadows, and the



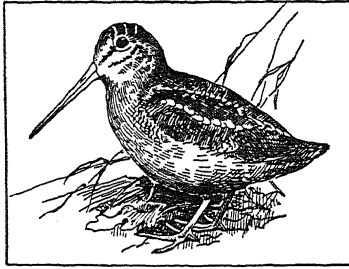
WOODCHUCK OR GROUNDHOG

only marmot east of the great plains. Several closely related species live among the mountains of the Pacific slope. Fully grown male woodchucks are about 2 ft. long; the females are smaller, and produce several young annually. Woodchucks have availed themselves of the privileges of civilization in its cleared fields, planted crops and gardens, which furnish more food than did the wilderness, and they sometimes become a nuisance, but in general the damage done is negligible. They excavate and live in extensive family burrows, to which, in northern states and Canada, they retire at the advent of cold weather, and sink into a profound, all-winter sleep or hibernation. The pelt of the woodchuck is utilized to some extent, but has little value as fur.

E. I.

WOODCOCK (*Philohela minor*), a well-known game bird of the snipe family found in alder swamps,

cornfields or wooded uplands from Manitoba and Nova Scotia southward to Texas and Florida. It is about 11 in. long with a compact, robust body, a long bill which is sensitive at the tip, large eyes and



DRAWING BY GEORGE MIKSCH SUTTON

AMERICAN WOODCOCK

head, and variegated ashy gray, reddish and black plumage. Nocturnal in habit, after nightfall the woodcock seeks its food of earthworms, which it obtains by turning over leaves or by probing in the soft earth with its sensitive bill. In the day time it remains quiet and concealed, unless disturbed, when it flies off swiftly but irregularly with whistling wings. At dusk during the spring it utters a clear, twittering whistle as it circles high in the air over the nesting ground. On leaves on the ground, chiefly in woods, it lays four, more or less spotted brownish eggs. The similar but larger Old World woodcock (*Scolopax rusticula*) is common in Europe. Both species are held in the highest esteem as game birds, and extensive hunting is rapidly diminishing their numbers.

WOODCOCK SHOOTING, a sport of Great Britain, Europe and North America. The woodcock, one of the shyest game birds, is one of the most difficult to bag. Woodcock love marshy thickets and are found seeking food in these during the day. When flushed, they seldom fly higher than the top of the thicket, but they sail some distance horizontally before settling to the ground again, with a series of zigzag movements which somewhat resemble those of a teal in flight. This makes them very difficult to hit. Bird dogs are almost always used to hunt woodcock in the United States; but in England they are more often driven to the guns by beaters. The ordinary load for woodcock is $3\frac{1}{2}$ drams of smokeless powder and $1\frac{1}{8}$ ounces of No. 6 or 7 shot.

WOOD CONSTRUCTION. Approximately two-thirds of the total quantity of wood used, as well as approximately one-half in point of value, finds its ultimate place in the construction trades, which take chiefly soft or coniferous woods, principally because of their low cost and great strength. House construction is the largest outlet for wood, including, as it does, practically everything in the home from foundation to roof.

The three principal types of frame house construction are roughly outlined as follows. Balloon frame building—Supporting studs extend from the foundation to the eaves, a ribbon or ledger board being set into the studs to form joist supports. This frame,

with its modifications, is the commonest type of construction, and is the outgrowth of early building methods during the last century. It is particularly adapted for stucco finish, since the exterior supports are continuous and endwise, eliminating vertical shrinkage. Braced frame construction—Originally a European method and more expensive, is sturdier than the balloon frame. Each story is a separate frame. Heavy knee braces are extensively used. It does not require timbers as long as does the balloon frame type of construction, and is, therefore, more adaptable to non-forestry areas where only local retail lumber yard stocks are available. Western frame building—This type is practically built story by story, and is sometimes called "platform frame" construction. Each story may be practically complete before proceeding to the next. This type has the advantage of eliminating unequal shrinkage between the side and end wood, using the same amount of horizontal lumber in both interior and exterior frames. Many combinations of these framing plans exist, each one having its individual merits.

The choice of wood for various house-framing units is important, depending upon the strength, cost and accessibility; i.e., studding must have tensile strength; the sub-floor, sheathing and roof boards may be of much cheaper grades of lumber. See MILLWORK.

T. D. P.

WOODCRAFT LEAGUE OF AMERICA, a recreational society, organized in 1902 by Ernest Thompson Seton. Its purpose is the development of character through an all year round program of recreation for both sexes and all ages, and its activities include athletics, nature study, handicraft, campercraft, hiking, homecraft, woodlore, townlore, swimming, dramatics, pantomime, dancing, photography, Indian lore and booklore. The League carries on its work through four branches: the Little Lodge for boys and girls under 12, the Big Lodge for young men and women from 12 to 18, and the Family Lodge for father and mother and all the children. Its name was chosen because "woodcraft in the beginning was the only science of man. It meant masterful touch with the things of his daily life, indoors and outdoors, near and far. So by growth and transference we define Woodcraft to-day as seeing, comprehending, and mastering the ordinary things of our daily life."

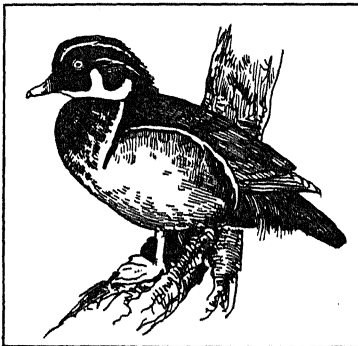
WOOD DISTILLATION. The present wood distillation industry developed from the old crude practice of making CHARCOAL. In the charcoal kiln the heat for the distillation was furnished by a partial combustion of the wood used and the volatile products of the distillation escaped with the products of combustion. In the modern industry the wood is heated in closed retorts and the charcoal remains in the retorts while the volatile products are passed through condensers and recovered. The volatile products consist of combustible gas, wood tar, and a watery liquid, called pyroligneous acid, that contains the main valuable chemicals, METHANOL and ACETIC ACID. In

refining the pyroligneous acid the primary products are crude methanol (wood alcohol) and acetate of lime. The crude methanol is refined into various grades of methanol, special solvents, and denaturing liquid, while the acetate of lime serves as a raw material for the manufacture of acetic acid or ACETONE. In the making of these products the hardwoods are used, the most valuable being beech, birch, maple, and oak. Air-dry wood in 4-foot lengths is commonly used, but processes have recently been developed for distilling smaller pieces such as blocks and even sawdust. Until about 1916 wood distillation was the only source of methanol, acetic acid, and acetone, but since that time new industries have been developed making these chemicals by synthetic or fermentation processes and from other raw material than wood.

There is a distinct branch of the wood distillation industry using resinous wood, such as the old stump wood and "lightwood" of long-leaf pine. The products from this material are charcoal, pine tar, wood turpentine, and various intermediate tar oils. The pyroligneous acid from this process contains so little acetic acid and methanol that the substances are not commonly recovered. Products of wood distillation in the pine areas are usually termed "naval stores" as they are used largely in building and maintaining marine structures.

L. F. H.

WOOD DUCK (*Aix sponsa*), a strikingly beautiful fresh-water duck, called also summer duck. It is



DRAWING BY GEORGE MIKSCH SUTTON

WOOD DUCK

found throughout temperate North America frequenting small lakes, ponds and streams in the close proximity of woodlands. The wood duck is about 18 in. long, with a small red and white bill. The male has a handsome crest marked with glossy green, purple and violet, a white throat patch, velvety black upperparts, chestnut breast, black and buff sides and white underparts; the female has duller plumage, varied with white. It flies with grace and rapidity, easily alighting in trees. It feeds chiefly upon insects, aquatic plants, acorns and other small nuts. In nests made usually in hollow trees, well above the ground and often far from the water, the wood duck lays 8 to 14 buffy white eggs.

WOOD-ENGRAVING, a method of cutting relief-blocks for multiple printing of pictures. The

modern engraver chooses between the revived art of woodcutting, dating from the early 15th century, and its antithesis, wood-engraving. To make a woodcut he selects a plank of soft wood, like pear, on which



WRESTLING IN THE MIDDLE AGES

From a woodcut by Lucas Cranach (1472-1553)

to execute his drawing. With a knife, drawn toward him as in carving, he cuts away the surface until his lines stand out in relief, like type. When inked and pressed on paper, the block prints black lines on the white.

When wood-engraving superseded woodcutting at the opening of the 19th century, the change was primarily one of material. The substitution of hard boxwood, sawn across the grain, made possible the BURIN, as in copper-engraving. This tool incises lines in the block which under surface inking, print white on black. The engraver now ordinarily conceives of his block as a black surface on which he draws in light. The term "white-line" applied to this process does not imply the elimination of black lines. The two often appear in the same print. The delicate work possible of execution on hard boxwood, especially in the rendering of tones, led to the high specialization of wood-engraving for the reproduction of paintings which were photographed directly on the block. Photo-mechanical processes have ended wood-engraving as a reproductive, although not as an original, art.

WOOD FINISHES, applications to wood surfaces to protect the wood from deterioration or to produce pleasing effects by taking advantage of the natural characteristics of the wood itself. The surface of the wood, after having been properly prepared by planing and scraping is given a coat of filler consist-

ing of a sharp-grained pigment such as silica with a proper binder. This coat serves to fill the pores of the wood and prepares it to receive the next coat. In case it is desired to change or modify the color of the wood and bring out its grain and texture, a wood stain may be used. Great care must be exercised in the selection of the stain if the desired result is to be obtained.

On the filler either varnish or lacquer may be used as a "finish" coat. VARNISH may be described in general terms as a liquid not containing pigment and capable of being spread in a thin homogeneous film which will dry to a hard coating. Modern LACQUER is a protective coating containing appreciable amounts of nitrocellulose, as well as gum, plasticisers, and volatile solvents. See also PAINTING. G. A. H.

WOOD FLOUR, an important ingredient in linoleum, plaster board, explosives and other semi-synthetic wood products. It is made from wood chips or sawdust of selected species which are dried, ground and bolted to the required fineness. White pine is one of the principal woods used in making the flour.

WOOD FUEL. Prior to the depletion of the forests, log or cordwood was extensively burned in the U.S. as a major fuel. To-day, its high cost largely confines its use to open fireplaces, as a "luxury" fuel. In forestry, lumbering and industrial operations, wood wastes are utilized as industrial fuel. See HOG FUEL. Such wastes are sometimes burned alone, but are generally supplemented by another fuel, such as pulverized coal. (See PULVERIZED FUEL.) When air dried, wood usually produces about 8,500 to 9,000 British thermal units per pound, or about two-thirds the amount of heat produced by coal. See also COAL; FUEL. H. W. B.

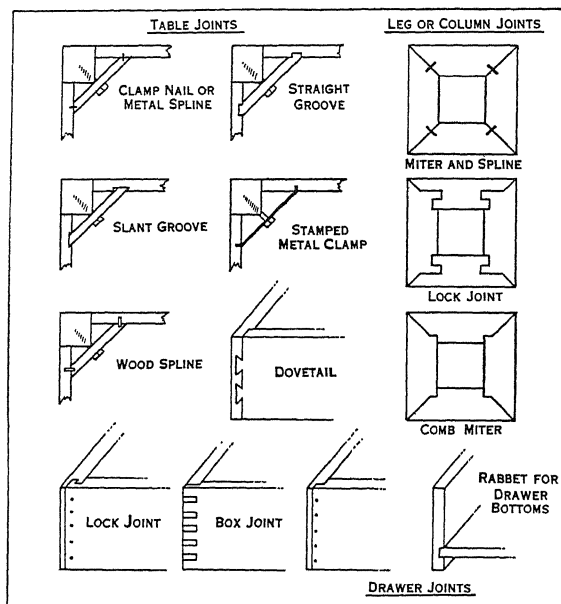
BIBLIOGRAPHY.—W. E. Goodrich, *Utilization of Low Grade and Waste Fuels*, 1924.

WOOD HEWER, the name for a family (*Dendrocolaptidae*) of tropical American birds allied to the ant thrushes and the South American ovenbirds, but in habit much resembling woodpeckers. There are about 100 species, all of small or medium size, with usually curved and sometimes long and slender bills, and brown plumage with reddish marks on the wings and with whitish spots below. The tail feathers are stiffened and sharp-pointed like those of woodpeckers, enabling them to climb easily up and down tree trunks, where in the crevices of the bark they seek their insect food. The wood hewers utter harsh notes and breed chiefly in holes in trees.

WOOD JOINTS. Many types of joints have been devised, other than glued ones, for attaching wood members together for columns and legs, table corners and box and drawer construction. These joints usually have interlocking wood members held by friction or locked tapers, and, in some instances, make use of wood or metal splines, as illustrated. Nails, screws and adhesives are frequently used as reinforcements.

WOODLAND, a city in northern California, county seat of Yolo Co., situated 20 mi. northwest of Sacramento, served by the Sacramento Northern and

Southern Pacific railroads. Woodland is a trade center for a region producing fruit, barley, sugar beets, alfalfa and dairy cattle. It has fruit and olive packing houses, a creamery and a concrete pipe factory. Pop. 1920, 4,147; 1930, 5,542.



TYPES OF WOOD JOINTS

WOOD LOUSE, a common name for members of a crustacean order (*Isopoda*) known also as pill or sow bugs, and particularly for the land-dwelling species (*Oniscoidea*) which breathe air. They are found almost everywhere in damp places under logs, stones and bark. See also PILL BUG.

WOODMEN OF AMERICA, MODERN. See MODERN WOODMEN OF AMERICA.

WOODMEN OF THE WORLD, SOVEREIGN CAMP OF THE, a fraternal and beneficiary society founded at Omaha, Neb., in 1890 as a division of MODERN WOODMEN OF AMERICA, of which it is independent. Negroes and women are excluded from membership to the organization which, however, maintains a separate society for the latter. A juvenile department admits children under 16. In 1932 total membership was 456,277 in the United States and Mexico. National headquarters are at Omaha, Neb.

WOOD OIL TREE, a name given to the TUNG, a medium-sized tree of the spurge family, extensively cultivated in China for its seeds which yield a valuable drying oil. See TUNG OIL.

WOODPECKER, the name for a large family (*Picidae*) of picarian birds, of which there are about 375 species, found widely in temperate and tropical regions. They are of small to medium size, with an elongated chisel-like bill well-adapted for cutting wood. The long tongue, usually barbed and sharp-pointed, can be thrust out to spear insects. Their strong legs and sharp-clawed feet, usually with 2 toes before and 2 behind, enable them to move about easily

on the trunks of trees; the short stiff tail also aids in climbing. In color their plumage is prevailingly black and white with red, yellow and green variously interspersed; many have handsome crests.

Woodpeckers are rather solitary but very active woodland birds, industriously searching the trunks of trees for insect food. The ground-feeding woodpeckers live largely upon ants; the arboreal feeders subsist mainly on the larvae of wood-boring beetles but also eat berries, seeds and small nuts, especially acorns which they sometimes store in holes drilled in trees. The sapsuckers live in part on the sap of trees. Although occasionally eating cultivated fruits and grain, woodpeckers rank among the most beneficial of birds, through the destruction of injurious insects, rendering important service to forestry and agriculture. Their notes are rather loud and harsh. Many resort to "drumming" which they produce by rapid blows of the beak on dry dead wood. Their flight is usually rapid and undulating. They nest mostly



IVORY-BILLED WOODPECKER

in hollows which they excavate in trees or sometimes in banks, laying three to nine glossy-white eggs.

In the United States and Canada about 40 species and varieties occur. Among those found in eastern North America are the golden-winged, red-headed, downy, hairy, red-bellied, ivory-billed and pileated woodpeckers, and also the yellow-bellied sapsucker. The western and south-

western species include the white-headed, golden-fronted, ant-eating, Texas, Arizona, and California woodpeckers, the red-shafted flicker, and the red-breasted sapsucker. See also FLICKER.

A. B. J.

WOOD PRESERVATION. To be successful wood preservatives must be toxic enough to kill fungi and insects, and they must be penetrating. In addition, from the standpoint of operation, the preservative should be available in large quantities, of uniform composition, and reasonably priced. Many chemicals may be used, but principally two classes, one of an oily nature, the other a salt which is injected into wood in the form of water solutions. Most of the wood treated in the United States is preserved by coal tar creosote and zinc chloride.

Creosote is highly toxic, which makes it very poisonous to wood-destroying fungi and to insects; its resistance to leaching, its low volatility, which cause it to remain in the wood for long periods, and its ease of application are valuable assets. Creosote is generally used for the treatment of timber where the odor is of little consequence and where painting is not necessary.

The principal advantages of zinc chloride as a preservative are its high toxicity to fungi and insects,

its cleanliness and lack of odor, its partially fire-resistant nature, and the fact that it does not discolor the wood.

These advantages are largely responsible for the increasing use of zinc chloride treated lumber in roofing and sub-roofing. A substantial market is being developed for zinc chloride treated wood for floors and other portions of residences which must be protected from decay and termites.

T. D. P.

WOOD PRODUCTS. The principal manufactured wood products of the United States, exclusive of lumber used rough or merely planed, consumed the following amounts of lumber in 1928:

MAJOR INDUSTRIES

	QUANTITY Bd. Ft.	PERCENT OF TOTAL
Millwork, incl. sashes and doors . . .	8,380,929 M	44.9
Boxes and crates	4,719,700	25.3
Furniture and chairs	1,364,004	7.3
Car construction & repairs	1,009,408	5.4
Motor vehicle bodies	867,875	4.7
Basket and fruit packages	261,530	1.3
Caskets and coffins	156,108	.8
Refrigerators and kitchen cabinets . .	145,745	.8
Agricultural implements	142,943	.8
Woodenware and novelties	142,299	.8
Fixtures, store and office	130,030	.7
Ship and boat building	128,342	.7
Handles	124,654	.7
Matches	115,943	.6
Musical Instruments	107,502	.6
Machinery and apparatus	106,377	.6
TOTAL	17,903,389	96.0

MINOR INDUSTRIES

Vehicles (non-motor)	80,841 M
Tanks & silos	66,328
Boot and shoe findings	48,742
Signs and supplies	48,597
Shuttles, spools and bobbins	44,022
Dairy, poultry and apiary supplies . .	41,037
Pencils and pen-holders	39,982
Toys	39,410
Laundry appliances	38,674
Boxes for cigars and tobacco	38,429
Patterns and flasks for foundries . . .	29,996
Sporting and athletic goods	29,973
Brooms and carpet sweepers	28,452
Rollers, shade and map	24,236
Trunks and valises	21,346
Frames and molding, picture	20,947
Brushes	17,033
Plumbers' woodwork	16,273
Motion picture and theatrical scenery	16,223
Instruments	15,510
Dowels	15,087
Sewing machines	12,760
Pumps and wood pipe	10,831
Airplanes	9,044
TOTAL	753,773

4.0

SUMMARY

Major manufacturing industries . .	17,903,389 M
Minor manufacturing industries . .	753,773
Rough and planed lumber, not re-	
manufactured (approx.)	16,500,000
TOTAL	35,157,162

Many products, formerly made of wood, have been superseded by sheet metal, plastics, fiber and pulp boards. See also FLOORING; MILLWORK; PLYWOOD; VENEER.

WOOD PULP. See PAPER.

WOOD-RAT, a native American rat (*Neotoma*), about the size of the house-rat, but with a hairy tail. These rodents, called also pack-rats and trade-rats, abound in the South Atlantic and Gulf states, occur everywhere west of the great plains, and also in Mexico. Ten species with many local varieties are listed, falling into two groups, those with a round, short-haired tail, and those with bushy tails which are restricted in range to our western mountains. These rats have soft fur, are cleanly, gentle, and convertible into pretty pets, and were it not for the name, would serve well as food. The species with short-haired tails pile on the ground large and conspicuous nests of leaves and twigs in which two or more litters of young are born annually.

The bushy-tailed species prefer house-room among rocks, yet make piles of rubbish, apparently only through an impulse for industry. The western species display most strikingly the proclivity of all wood-rats to collect and take to their nests or hide bright objects of all sorts. Campers, miners and frontier settlers continually suffer the loss of small tools, buckles, table knives and spoons, stolen by pack-rats in the night, and hoarded by them, apparently without purpose; these articles can usually be easily recovered in the morning. An interesting trait in connection with this habit is that of leaving, in place of the stolen object a pebble or the like, as if in exchange, hence the name, trade-rat. These rats frequently invade houses and barns, but do not often take up their residence there, and are harmful only by making noises, and occasional pilfering.

WOOD-RIDGE, a rapidly growing borough of Bergen Co., N.J., situated on rising ground overlooking the tidal flats of the Hackensack River and affording a view of almost the entire metropolitan district. It is served by the New Jersey and New York Railroad and motor bus lines. It is strictly a residential community having the suburban homes of many New York City workers. Pop. 1920, 1,923; 1930, 5,159.

WOOD RIVER, a city of Madison Co., Ill., on the Mississippi River, 6 mi. southeast of Alton. It is served by several railroads. Oil refining is the chief industry; coal mines and limestone quarries are found in the vicinity. The Lewis and Clark Expedition made winter encampment, 1803-1804, at the stream of Wood River. A monument in Vaughn's Cemetery commemorates the Wood River massacre, July 10, 1814. The location in 1907 of the Standard Oil Company of Indiana refinery was the beginning of Wood River village, incorporated as a city in 1923. Pop. 1920, 3,476; 1930, 8,136.

WOODRUFF (*Asperula odorata*), a small perennial herb of the madder family, commonly called sweet woodruff. It is a native of Europe and Asia cultivated as an ornamental and also for its fragrant

foliage used for flavoring and in perfumery. The slender, square stem, a few inches high, bears narrow, whorled leaves and numerous small white flowers.

WOODS HOLE, a village in the town of Falmouth, Barnstable Co., southeastern Massachusetts. It is situated on Vineyard Sound near Buzzards Bay and is served by steamers to New Bedford and Nantucket, and by the New Haven Railroad. A marine biological laboratory is located here. Pop., including Falmouth, 1920, 3,500; 1930, 4,821.

WOOD SORREL (*Oxalis Acetosella*), a small, stemless perennial of the wood sorrel family called also sheep sorrel. It grows in cold, damp woods widely throughout the north temperate zone. The scaly rootstock sends up long-petioled, clover-like leaves and short flower-stalks each bearing a single white or pink flower. The slightly acid foliage yields the salt of lemons of the druggists. See also OXALIS.

WOODSTOCK, a city of Oxford Co., and a port of entry in Ontario, Canada, lying on the Thames River and Cedar Creek, about 84 mi. southwest of Toronto. It is served by the Canadian National and the Canadian Pacific railroads. Cheese, butter and live stock from the fertile countryside are extensively exported by rail. The manufactures include furniture, agricultural implements, organs, pianos, curtain rods, stoves, textiles and rubber goods. Pop. 1921, 9,945; 1931, 11,391.

WOODSTOCK, a city and the county seat of McHenry Co., Ill., 51 mi. northwest of Chicago. It is served by the Chicago and North Western Railroad. Woodstock is the seat of Todd Seminary for Boys (1848). Manufactures include feed, pickles, creamery products, foundry and machine-shop articles and typewriters. The city handles farm produce of the district. Pop. 1920, 5,523; 1930, 5,471.

WOOD UTILIZATION. Conventional log and lumber conversion methods usually result in the manufacture of approximately 50% of the solid material from the tree into commercial lumber or boards. The conversion of lumber into the ultimate product seldom yields more than 50% net. A piece of household furniture, therefore, usually represents not over 25% of the original tree. The manufacture of VENEER and PLYWOOD results in much better utilization, as it eliminates saw kerf. Another conservative measure is the conversion of the tree or the log into the ultimate product without an intermediate lumber form. These direct methods show marked improvement in wood utilization.

WOOD WARBLER, the name of a numerous exclusively American family (*Compsothlypidæ*) of small passerine birds, somewhat allied to the honey creepers and wagtails. There are about 200 species widely distributed in North, Central, and South America. Of about 70 species found in the United States all but a few are highly migratory, appearing in late spring enroute to their summer breeding grounds, mainly in Canada but also in Alaska, and returning in early autumn to winter in the southern states or farther south. They are mostly between 4

and 6 in. long., have slender or flat bills, somewhat pointed wings with 9 primaries, and rounded tails. In the main they are birds of beautiful plumage, predominantly yellow in hue, but usually more or less marked in attractive patterns with black, olive-green, gray or white.

Most wood warblers feed exclusively upon insects, living and nesting in trees, though some dwell on or near the ground. As a group, they are birds of weak, inferior song; a few, however, utter melodious, ringing notes. They usually build compact, well-constructed nests, placed in forking branches, or rarely on the ground or in a hole in a tree. The whitish eggs, usually four or five in number, are often dotted with brown. See also CHAT; OVENBIRD; WATER THRUSH; YELLOWTHROAT. A. B. J.

WOODWARD, a city in northwestern Oklahoma, the county seat of Woodward Co., situated on the North Canadian River, about 150 mi. northwest of Oklahoma City. Two railroads serve the city. There is an airport. Woodward is a market center for the agricultural products of the vicinity, chiefly grain, live stock and poultry. Fuller's earth is found in this region. A United States Agricultural Station is located here. Near by is Lake Woodward, an artificial recreational lake. Woodward was founded in 1886; incorporated in 1907. Pop. 1920, 3,849; 1930, 5,056.

WOODWORKING MACHINERY. Woodworking was generally done by hand prior to 1800. Following the introduction of the steam engine, wood-working machines came into use. The development of working machinery followed the general line of the metal working machinery, and eventually developed an individual type.

Saws are either of the circular type up to approximately eight feet in diameter, or band type, either endless over wheels or reciprocating jig saw design. The tempering and maintenance of saw teeth is highly important. Saws are single operating, or are arranged in multiple batteries with a variety of heads to perform complex operations. Planers are revolving cutter heads with one to 12 knives. Planers may be single surfacing or double surfacing. The planer used for edge work is termed a jointer. Moulders or stickers are planers with four heads (two each horizontal and vertical) with either straight or irregular knives which will produce mouldings, tongue and groove lumber, ship lath and a variety of intricate forms. Shapers have one or more vertical spindles equipped with revolving cutter heads to shape table edges, mirror frames, toilet seats and the like. Shapers are particularly suitable for cutting end wood; moulders cut only side wood.

Sanding machines have endless sand belts or drums, with automatic or hand control, to prepare wood surfaces for eventual finishing operations. Sand belts are made flexible for sanding curved pieces; also in revolving drum and flat disc types for hand work. Drills and boring machines have both single and multiple spindles, and can be arranged with universal sockets to drill as many as thirty holes simultaneously.

The work is brought up to the drills rather than the drills lowered into the woods. Mortisers and tenoners were originally developed for manufacturing door frames and window sashes, but have been perfected for complex furniture manufacturing operations by having one or both ends prepared for wood jointing. Lathes have been developed for hand and automatic production of spindles, dowels, posts and legs. Large lathes are utilized for cutting logs into VENEER. Wood-working machinery was originally driven by foot pedals, followed by the belt drive. They are now driven by electric motors. T. D. P.

WOODWORTH, SAMUEL (1785-1842), American poet, was born in Scituate, Mass., Jan. 13, 1785. Entering journalism, he edited several unsuccessful newspapers in New Haven and New York City. He edited the *Parthenon* in 1827, and was the author of several operettas, including the highly successful *Forest Rose*. The best known of Woodworth's numerous lyrics is *The Old Oaken Bucket*. His poetical works were collected and edited by his son in 1861. Woodworth died in New York City, Dec. 9, 1842.

WOOL, a term distinguishing the hair of the many varieties of SHEEP and allied animals found wild or domesticated, between the latitudes 60° North and 60° South. The Southern Zone, which includes Cape Colony, Australasia, and South America, furnishes the greater part of the finer wools; the United States, Canada, and Newfoundland produce fine, medium, and coarse wools; Europe, Iceland, and Great Britain yield wools of a medium quality; while Egypt, Turkey, Persia, Russian Siberia, China, Northern India, Thibet, and Afghanistan produce a low grade wool. The latest reliable figures indicate that there are 739 million sheep in the world, yielding 3682 million pounds of "grease" wool from which are obtained 2210 million pounds of clean wool. Approximately 60% of the wool produced is of the finer grades. Wool, as a textile, is important because it is easy to spin into a fabric of wide utility.

The fibers generally included in wool manufacture are: mohair, alpaca, camel's hair, cashmere, cow hair, rabbit hair, vicuna wool, kangaroo hair, and horse hair. The breed of sheep and the country or origin both have an influence on the quality and "staple." *Merino* wools are "fine," of a high quality, but of relatively short staple. *Lincoln* wools are coarse, and of long staple, but possess great lustre. *Southdown* wools grade between Lincoln and Merino wools.

Wool is divided into two main classes: (1) *Clothing Wools* three or four inches long, primarily for woolen manufacture, and (2) *Combing Wools*, essentially worsted wools, including all wools three to 15 inches long. Rags from woolen and worsted fabrics, wool wastes and "noils" are used as raw material for "reworked wool." COTTON is used with reworked wools as a wool substitute. The production of reworked wool includes: (1) *Dusting*, a hygienic process; (2) *Sorting*, to separate quality, color, or both; (3) *Seaming*, removing cotton thread from seams; (4) *Carbonizing*, to remove vegetable fibers; (5) *Oil-*

ing, to lubricate the fibers to provide a longer staple; (6) *Grinding*, shredding the rags.

YARN MANUFACTURE

In "worsted" yarn, the fibers are approximately parallel to each other, producing a smooth, lustrous yarn. A "woolen" yarn is generally rough, lustreless, and bulky, with many free ends projecting.

Woolen Yarn. Woolen yarn manufacture essentially consists of the following processes: *Sorting*, the separation of the "fleece" according to quality, length, soundness and color. Fleece may have five or six "qualities" in different places. "Sorting" gets the maximum average value from each fleece. Sorting for worsteds must eliminate all "shorts." *Scouring*. The removal of the 60% of grease and earthy matter. *Carbonizing or Burr Picking*. Burrs can be "picked" out. Very "seedy" wools must be submitted to "carbonizing," a process which "burns" out all vegetable matter, yet is so controlled that the fiber is scarcely injured—SULPHURIC ACID, aluminum chloride, and other chemical agents being used. *Dyeing* follows carbonizing. *Oiling and Blending*, a methodical arrangement of the various materials in layers to make a pile 12 ft. x 12 ft. and six ft. high, those layers requiring it being oiled at this time, thus lubricating and softening the fibers to reduce both waste and "fly," and minimizing the subsequent breakage of fibers. The pile of "blended" material is "sliced" vertically and passed through the *Mixing Picker* which has spiked rolls running at different speeds, opening up and mixing the materials in the blend. **CARDING**, in woolen yarn manufacture, is the most important process. **SPINNING** may be done on a "frame" or a "mule."

Worsted Yarn. Worsted yarn manufacture duplicates that of woolen yarns up to *Carding*, which is not so severe for worsteds as for woolens. *Gilling*, during which the wool passes through a "gill" box which draws it between pins, thus straightening it preparatory to **COMBING**, which removes all foreign matter, and a certain percentage of short fibers. **DRAWING** follows combing and consists of operations which produce an evenness suitable for **SPINNING**. **TWISTING** follows, a process of twisting single yarns together to meet the demands of knitters and weavers.

CLOTH MANUFACTURE

Yarns may be made into knitted or woven fabrics. See **KNITTING** and **WEAVING**.

Finishing of Wool Fabrics is the final process. The main operations are *Perching*, locating and marking defects. *Burling*, the process of raising knots, pushing all "face" knots to the back, and also removing or thinning out thick uneven places in the yarn called "slubs," and "swells." *Mending*, the replacing of missing threads or wrong threads in the fabrics. *Crabbing*, an operation producing firmness and body, a fundamental operation with goods not felted. *Scouring*, a cleansing process. *Fulling*, which produces firmness, body, and "cover." *Extracting*, the removal of surplus moisture. *Singeing*, the burning off of projecting fibers from the face of the cloth. It is a

worsted process. *Napping and Gigging*, processes used to raise a "nap" or pile on the face of the cloth. A napper uses wire covered rolls. A gig uses burrs or TEASELS. *Blow Steaming*, the forcing of steam through cloth under pressure to produce a luster. *Decating*, a method of dry steaming cloth after pressing to set the fiber and modify the luster. *Steam Brush*, a process which moistens the fabric previous to shearing or pressing. *Shearing*, the removal of long fibers projecting from the cloth. *Pressing*, the smoothing and the flattening of the cloth under the right conditions of moisture, heat and pressure.

WOOL INDUSTRY

In 1930 approximately 397,907,000 pounds of grease wool was produced. The annual consumption is about 600,000,000 pounds. The latest industrial census shows the following statistics for the United States:

Sets of cards	6,585
Combs	2,754
Woolen spinning spindles	2,247,000
Worsted spinning spindles	2,550,000
Looms weaving men's wear	45,000
Looms weaving women's wear	20,000
Looms (carpet and rug)	9,000
Annual Sales of Wool Cloth	\$656,000,000
Estimated total investment	\$660,000,000

The extent of the wool production of the world as estimated by the Bureau of Agricultural Economics can be gathered from the following table:

Sources	Total Sheep	Lbs. of Wool
United States	51,911,000	397,907,000
Canada, Newfoundland	3,789,000	21,207,000
Central America, Mexico and the West Indies	3,225,000	12,400,000
South America	99,091,000	546,107,000
Eu- { France, Germany and others	79,510,000	309,973,000
rope { Spain	19,370,000	75,000,000
United Kingdom	28,196,000	152,644,000
Asia	237,996,000	616,702,000
South Africa	41,600,000	337,000,000
Other Africa	38,146,000	100,344,000
Australia	105,896,000	871,256,000
New Zealand, Tasmania and other Oceania	30,737,000	241,770,000
Total for the World	739,467,000	3,682,310,000

The wool production in the United States is:

WOOL PRODUCTION, U.S.

4-Year Average, 1927-30

Division	Production (Lbs.)	% of Total
UNITED STATES	308,050,000	100.0
LEADING STATES:		
Texas	38,456,000	12.5
Montana	28,241,000	9.2
Wyoming	27,041,000	8.8
California	25,059,000	8.1
Utah	20,664,000	6.7
Oregon	19,671,000	6.4
Idaho	17,580,000	5.7
Ohio	14,982,000	4.9
New Mexico	14,262,000	4.6
Colorado	9,713,000	3.1

J. C. L.

WOOLF, VIRGINIA (1882-), English author, was born at London in 1882, the daughter of Sir Leslie Stephen. She was educated at home. In 1915 she published her first novel, *The Voyage Out*, followed by *Night and Day*, 1919. With *Monday and Tuesday*, short stories, she began experimenting with methods that would reveal the inmost heart of her characters. In subsequent novels, *Jacob's Room*, *To the Lighthouse*, *Mrs. Dalloway* and *Orlando*, she developed this aim until the endeavor to set forth the secret thoughts, feelings and motives of her characters became the mainspring of her technique. Among Mrs. Woolf's other works are *The Common Reader*, 1925; *A Room of One's Own*, 1929, and *The Waves*, 1931.

WOOLLEY, MARY EMMA (1863-), American educator, was born at South Norwalk, Conn., July 13, 1863. She was an instructor at Wheaton Seminary from 1886-91 and then went to Brown University, where she graduated in 1894. She was one of the first two women admitted to this university. From 1895-1900 she taught at Wellesley College, the last two being professor and head of the department of Biblical history and literature. In 1900 she became president of Mt. Holyoke and through her outstanding administration of this college has become recognized as one of the leading women educators. While the college has been the center of her interests, she has been a very active member in organizations working for woman suffrage, labor legislation and judicial settlement of international disputes. She has been an ardent and outspoken supporter of the League for Permanent Peace. In 1922 she was a member of the China Education Committee which investigated institutions for higher education in China, Japan and Korea. President Hoover appointed Miss Woolley as a member of the American delegation to the General Disarmament Conference of the League of Nations which met at Geneva in 1932. Among her writings are *Early History of the Colonial Post Office*, 1894; *The College Woman and the New Epoch*, 1916; and many educational articles.

WOOLMAN, JOHN (1720-1772), American Quaker missionary, was born at Northampton, N.J., Aug. 1720. When 21 he began speaking at Friends' meetings and in 1746 set out to visit outlying communities of Friends in Virginia and other colonies. He spent the remainder of his life in this itinerant preaching and in opposing slavery, and left an interesting *Journal* of his life and travels. Woolman died at York, England, Oct. 7, 1772.

WOOLSACK, a red colored cushion in the chair in which the British Lord Chancellor sits when presiding over the House of Lords. Technically, it is considered to be outside the precincts of the Chamber—and this may be the occasion for the fact that the Lord Chancellor's powers as presiding officer of the Lords are slight as compared with those of the Speaker of the House of Commons. See also PARLIAMENT.

WOOLSEY, THEODORE DWIGHT (1801-89), American educator, was born at New York, N.Y.,

Oct. 31, 1801. After graduating from Yale University in 1820 he studied law in Philadelphia and theology at Princeton University. For two years, 1823-25, he was a tutor at Yale but then decided to go abroad to travel and study. From 1827-30 he studied languages at Leipzig, Berlin and Bonn, returning to Yale the next year as professor of Greek language and literature. In 1846 he was elected president of the university and entered the Congregational ministry. During his administration the Graduate School was established and the Scientific School and School of Fine Arts opened. Woolsey was particularly interested in international law and continued to lecture on this subject after he resigned as president in 1871. He was interested, too, in the revision of the authorized version of the New Testament and devoted many years to this work.

Among his writings are *Introduction to the Study of International Law*, 1860; *Essays on Divorce and Divorce Legislation*, 1869, *Religion of the Present and Future*, 1871; *Political Science*, 1877; and *Communism and Socialism*, 1880. He died at New Haven, Conn., July 1, 1889.

See T. S. Woolsey, *Theodore Dwight Woolsey—A Biographical Sketch*, 1912.

WOOLWICH, a metropolitan borough of London, England, lying to the southeast, largely between Shotter's Hill and the Thames. Of probable Roman foundation, in the early 16th century, it became a prominent naval station where, in 1512, Henry VIII launched the epochal thousand-ton *Harry Grace à Dieu*. Remaining the premier naval station of England until the advent of iron ships, after the closing of the docks, 1869, the local military atmosphere was carried on by the Arsenal, Royal Artillery headquarters, and Military Academy founded in 1741. The school, for the instruction of artillery and engineer officers, includes in its honor roll General Gordon and Lord Kitchener, and, during the World War advanced the average enrollment to 500 cadets. Pop. 1921, 140,389; 1931, 146,944.

WOOLWORTH, FRANK WINFIELD (1852-1919), American merchant, born at Rodman, N.Y., Apr. 13, 1852. He began his career as a five-and-ten-cent-store merchant in 1879 with a five-cent store in Utica, N.Y. His first enterprise failed, but he was still convinced that his idea was sound. He soon started a five-and-ten-cent store at Lancaster, Pa., and another at Harrisburg. From this beginning, the F. W. Woolworth Co. was developed. It was incorporated in New York in 1911, absorbing similar concerns which had in the meantime been started by several of his relations and personal friends. Today, the company operates stores throughout the United States and in Canada, Cuba, England and Germany. At the time of his death, Woolworth had accumulated a fortune of \$27,000,000. He died at Glen Cove, Long Island, N.Y., Apr. 8, 1919.

WOOLWORTH BUILDING, an office building in New York City, opened in 1913, once the largest structure of its kind in the world. It was designed

by Cass Gilbert and financed by F. W. Woolworth. The principles of Gothic architecture were combined with the requirements of a 58 story, vertical office building, 792 ft. high.

The foundation, consisting of 69 pieces of partly reinforced concrete, is sunk through 115 ft. of quicksand to bed rock. The weight of the building it must support is 206,000,000 pounds. Floor space covers more than four acres. Building materials used in the exterior are polished granite for 7 ft. above the curb, Bedford limestone to the 43rd story and terra cotta the remainder of the way. The interior of the entrance corridor is lined with colored marble and decorated with wrought-iron covered with gold leaf; the vaulted ceiling is done in glass mosaic. Well known mural paintings by Paul Jennewein are on the mezzanine floor.

WOONSOCKET, a city of Rhode Island, on the Blackstone River, about 15 mi. northwest of Providence and served by the New Haven Railroad. Manufactures include cotton, woolen, yarn, plush and knitted goods, clothes wringers, rubber products and machine tools. In 1929 the value of the factory output was about \$81,000,000; the retail trade amounted to \$23,400,341. Water-power is furnished by the Blackstone and two tributaries. Originally settled about 1666 by Richard Arnold, local saw-mill owner, the town was part of Cumberland until 1867, when separate incorporation occurred; several factory villages, apart from the first Woonsocket, consolidated to form the present city, incorporated in 1888. Pop. 1920, 43,496; 1930, 49,376; 37% foreign-born.

WOOSTER, a city in northeastern Ohio, the county seat of Wayne Co., situated 54 mi. southwest of Cleveland. Two railroads and bus and truck lines afford transportation. There is an airport. Wooster is in the center of an oil and gas producing region. It has various manufactures, including a paintbrush industry. The retail trade in 1929 amounted to \$10,439,431. Wheat is the chief crop of this district. A state agricultural experiment station and Wooster College are located here. The city was founded in 1808, being named for Gen. David Wooster, and was chartered in 1869. Pop. 1920, 8,204; 1930, 10,742.

WOOSTER, COLLEGE OF, at Wooster, O., a coeducational institution controlled by the Synod of Ohio, Presbyterian Church, U.S.A. It was founded by the Presbyterians of Ohio in 1866. The productive funds in 1931 amounted to \$3,267,608. The library contained 60,810 volumes. In 1931-32 there were 865 students and a faculty of 75, headed by Pres. Charles F. Wishart.

WORCESTER, an episcopal city situated on a ridge paralleling the Severn about 120 mi. northwest of London. Becoming a see in the 7th century, it was twice overrun by Danes, and after the Conquest suffered from fire six times within a century. Nevertheless, many fine ancient structures survive, including the cathedral. (*See WORCESTER CATHEDRAL.*) Of the Norman castle only the site remains, but the 11 parish churches have an architectural range from early

Norman. The Commandery, founded as a hospital in 1085, was splendidly rebuilt in Tudor times, and many half-timbered houses lend a picturesque quality to the city. To-day, besides its ecclesiastical interest, Worcester manufactures gloves and porcelain and has iron, engineering and automobile factories. Cider and the famed sauce are made here and there is a large hop mart. Pop. 1921, 48,833; 1931, 50,497.

WORCESTER, the second largest city in Massachusetts, a county seat of Worcester Co., situated near Lake Quinsigamond, 42 mi. west of Boston. It is served by four railroads and by bus and truck lines. Worcester has more than 600 industrial plants and factories. The principal products are steel and wire, machine tools, grinding wheels, carpets, rugs and envelopes. In 1929 the factory output was valued at about \$215,000,000; the wholesale trade proper amounted to \$46,516,633; retail trade, to \$108,555,686.

Worcester is the seat of a number of important educational institutions including Clark College and University, Worcester Polytechnical Institute, Worcester Academy, the Jesuit College of the Holy Cross and a state normal school. Among buildings of note are the public library, the American Antiquarian Society and Worcester Historical Society. The city has several parks, totaling approximately 1,000 acres. Worcester was first settled in 1674, was named and re-settled in 1684 and permanently settled in 1713; the town was incorporated in 1722 and was chartered as a city in 1848. The Blackstone Canal, a waterway to Providence, was completed in 1828. In 1854 the slavery question caused serious civic disturbance. Worcester has been the home of many celebrities, among them Elias Howe, Eli Whitney, Gen. Rufus Putnam, Dorothea Lynde Dix and Clara Barton. Pop. 1920, 179,754; 1930, 195,311.

WORCESTER CATHEDRAL, Worcester, England, notable for its early development of Gothic architecture, was built mainly in the Early English and Decorated styles, but contains examples of all the English Gothic periods. The circular chapter house, built in the 12th century, affords one of the first examples of vaulting borne on a central shaft. Francis Bond dates the western bays of the nave, which are Early English work of the 12th century, as even earlier than the first Gothic of Lincoln Cathedral. The edifice occupies the site of an 11th-century Norman church of which the interesting crypt remains, together with some portions of the walls. The beautiful choir and lady chapel are of the early 13th century. The nave was erected in the 14th century. The long line of the groined roof, 387 ft. in length, produces the most striking effect inside the cathedral. A charming detail is also found in the 14th century choir stalls. The cathedral was restored throughout the 19th century.

WORCESTER POLYTECHNIC INSTITUTE, a privately controlled, non-sectarian institution for men at Worcester, Mass., was founded in 1865 by John Boynton. The name of Worcester Polytechnic Institute was assumed in 1887. The institution is de-

voted entirely to general science and engineering. Gifts from individuals and from the state have increased its resources and enabled it to maintain its position among the leading technical schools in America. It had productive funds in 1931 amounting to \$2,968,400. The library contained 23,500 volumes. In 1931-32 there was a student enrollment of 702 and a faculty of 74, headed by Pres. Ralph Earle.

WORDSWORTH, WILLIAM (1770-1850), English poet, was born Apr. 7, 1770, in the village of Cockermouth, Cumberland, of an old Yorkshire family. His father was an educated man, but at the time of Wordsworth's birth was acting as a land agent, and the poet's childhood was passed in a home of austere simplicity. He was orphaned at 13, but his guardian uncles, who planned to educate him for the church, sent him to St. John's College, Cambridge, where he spent three undistinguished years. Perhaps Wordsworth's religious ideas were already unorthodox. At any rate, he persuaded his uncles that a year in France would be valuable for him, and after his graduation in 1791, he went to the Continent.

All his life Wordsworth had the tendency to become the ardent disciple of men philosophically more daring than he. In France he entered fervently into the revolutionary ideals that were setting that nation on fire, and came back to England under the spell of Rousseau. While in France, he had undertaken the writing of *Descriptive Sketches*, and had finished *An Evening Walk*, which was begun in his student days at Cambridge. Both books appeared in 1793; and in the same year, to Wordsworth's consternation, England declared war on France. For some time the poet was the passionate defender of England's enemy, but eventually the excesses into which the revolutionaries fell alienated him. He sat at the feet of William Godwin, the most influential of his philosophical guides, and became a devotee of pure Reason.

In 1795 he met SAMUEL TAYLOR COLERIDGE. The interaction of the two temperaments gave rise to the most considerable literary epoch in England since Milton. The same year brought Wordsworth a legacy which enabled him to live comfortably, and with his sister Dorothy he set up a home near Coleridge. In 1798 the two poets published *Lyrical Ballads*, and their influence on literature began. (See also ROMANTICISM.) In the "Advertisement" to the volume Wordsworth set forth his literary creed, that no subject interesting to the human mind was unsuitable to poetry, his theory of the Imagination, and his exhortation to the poet to put himself into a state of "wise passiveness" toward Nature. In 1798 he began his long autobiographical poem, *The Prelude*, and in the following years began its fragmentary sequel, *The Recluse*, and *An Excursion*. *Poems in Two Volumes* was published in 1807, and Wordsworth's period of real creativeness drew to a close.

In 1799 the Wordsworths had moved into Dove Cottage, Grasmere, in the Lake Country, and in 1802 Wordsworth married Mary Hutchinson. In 1813 he was given a titular government post which provided

for him comfortably and after 30 years of publishing and republishing his early work, with the occasional addition of new poems, he was made Poet Laureate, succeeding ROBERT SOUTHEY in 1843. Toward the close of his life his most radical and fervent disciples felt deserted and betrayed by his obvious turn toward orthodoxy; but Wordsworth was the great and recognized man of his day, and reaped the full rewards of his genius within his lifetime. He died at Grasmere, Apr. 23, 1850. See also ENGLISH LITERATURE.

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WORK, the product of the FORCE acting and the distance through which its acts. Thus, $Work = Force \times distance$ or $W = Fd$. This equation which defines work also provides the means for defining the units of work. In the METRIC SYSTEM, the dyne is the fundamental unit of force and the centimeter, of distance. Therefore, the unit of work is the *dyne-centimeter*, which is called the *erg*. In the English system of units the force of attraction of the earth for a pound mass is taken as the unit of force, and the foot as the fundamental unit of length. Therefore, the unit of work in the English system is the *foot-pound*.

The erg is a very small unit of work. A larger unit would be more convenient. This is taken care of by the *joule*, which is 10^7 ergs of work.

WORK, PSYCHOLOGY OF, a science regarding work as an activity with an end in view. It differs from play in that the emphasis is placed on the end of activity rather than on the activity itself. In work, interest is in the goal to be reached and the end to be achieved.

Obviously the psychological distinction between work and play is a relative one. A work element is often introduced into play and a play element is frequently found in work. If work is really interesting there is a play element in it. Interest in work means that the means and the end of activity are in conjunction. The end has not been too far removed from the means for interest to be maintained in the process. When the means and ends of activity become divorced from one another the result is drudgery. Psychologically drudgery means that there is no interest in the activities themselves. They are carried on solely for the purpose of gaining an end from which they have been detached. Work has lost its play element when drudgery occurs.

Play is not merely play and work is not merely work. Many persons play while they work, others make work of play. The individual who likes his work often finds it difficult to play in the ordinary sense of the word. That there is a large work element in many games is quite apparent. Remove the goal of action and the game would cease to be a game.

WORKERS, SELECTION OF. See PERSONNEL MANAGEMENT.

WORKERS' EDUCATION, a system having certain definite characteristics. It is democratic and voluntary in that the group of workers determines what it shall study, when it shall study and under what conditions study shall be pursued. It is non-academic and noninstitutional in that there are no examinations, no courses for credits and no degrees.

The Workers' Education Bureau is a cooperative undertaking that brings together for purposes of education trade unions and workers' educational enterprises. There were in 1929 in active affiliation with the bureau more than 800 national and international unions, state federations, local bodies and workers' educational enterprises. These unions thus cooperating with the bureau represent nearly 1,500,000 members and thus constitute one of the largest adult movements in the country.

Although courses of instruction and lectures at summer schools have been given in several institutions, and also special conferences arranged for the training of teachers of workers' education, such training as a systematic effort has yet to be developed in the United States. See also LABOR SCHOOLS. S. M.

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WORKMEN'S COMPENSATION. Workmen's compensation laws provide, in addition to medical care, for the payment of a part of wages to a worker disabled by an industrial accident—or to his dependents if he is killed. The cost of this relief is borne by industry as a part of the cost of production.

The principle had been widely accepted in other countries when it was first definitely established in the United States in 1911. This legislation in 1931 was in successful operation in 44 states, three territories and the Philippines, in addition to the three Federal laws for civilian employees of the Government, for longshoremen and harbor workers and for private employees in the District of Columbia. Only four states remain without workmen's compensation: Arkansas, Florida, Mississippi and South Carolina. Seamen and railroad employees in interstate commerce are likewise without this protection.

Under a compensation law, medical treatment is provided immediately following an injury. Compensation begins after a short waiting period and is paid promptly and regularly to the person entitled to it in the same manner as wages. The amount is fixed at a certain percentage of weekly wages, within specified limits, and is graduated according to the degree of disability. Employers are required to insure their compensation liability either by maintaining their own insurance fund subject to the approval of the administrative authority, insuring in an authorized mutual employers' association or in a stock insurance company, or insuring in a state insurance fund managed by the administrative commission. Disputes are settled in most states by an administrative commission after informal hearing. Necessary constitutional appeal to the courts on questions of law is provided.

Important provisions which are now regarded as

standard and toward which most of the laws are tending include all necessary medical care, a noncompensated waiting period of not more than seven days, and the payment of at least two-thirds of wages as compensation subject to a weekly maximum of not less than \$20. Administration by a commission is likewise almost universally recognized as essential to the proper operation of a workmen's compensation law.

In 1931 some 17,000,000 American workers and their families were protected by workmen's compensation laws under which more than \$150,000,000 was awarded annually on account of occupational injuries. Since the purpose of the law is not only to provide relief when most needed but also to restore the injured man as completely and quickly as possible to his job, special emphasis is placed on the retraining of industrial cripples and on accident prevention.

One of the most beneficial effects of workmen's compensation is the incentive given to employers to prevent accidents—a continuous economic pressure to develop and maintain safety practices. It is generally recognized that workmen's compensation has proved to be the greatest single stimulus to accident prevention work. The most striking progress in organized safety work has been made in those states where the commission has been empowered to formulate and after hearing to issue administrative safety orders having the force of law. J. B. A.

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WORKSHOPS, in archaeology, are sites at which flint or other implements were made, often during long periods of time. There is a famous Workshop at Cissbury, near Worthing on the coast of Sussex, England, at which flints were regularly mined. There are two fairly deep shafts some distance apart and joined at the bottom by a gallery. Pickaxes of deer horn and of flint were used to detach the flint nodules from the chalk, in which pick marks can still be traced. Cups of chalk have been found, which may have been used as oil lamps. Many unfinished or defective flint implements have been found close to the pits. In working the flints pebbles were used as hammers, and larger stones as anvils. More delicate flaking was done with instruments of horn, using pressure instead of a blow. There are well-known workshops at Whitepark Bay, Antrim, Ireland, and at Spiennes in Belgium.

WORLD, strictly speaking only another name for the earth, the planet on which we live. It is used in a more restricted sense to indicate large self-contained portions of the earth, such as the "New World," or with an enlarged meaning to include any celestial object bearing resemblance to the earth in some respect. Its use in the figurative sense is manifold and may signify large or important divisions in space, time, thought and custom.

WORLD COURT. See PERMANENT COURT OF INTERNATIONAL JUSTICE.

WORLD FAIRS. The history of international expositions, held to promote trade and to advertise the

products of one nation to another, began in England in the middle of the 19th century. Such large scale exhibitions are, of course, a simple development of the trade and pleasure fairs common to Europe and Asia for centuries. When the gradual industrialization of Europe necessitated a larger market for the flood of products made by machinery, the transition of the local fair of long standing to an exhibition participated in by the manufacturers of several countries, was a manifest necessity. The chief requirement was a tactful organization competent to deal with the demands of the foreign exhibitors. The father of the modern exposition, or world fair, was possibly the Prince Consort Albert, who in 1848 while president of the Society of Arts, proposed to the British public an international exhibition to be held at London. A royal commission was appointed by Parliament, subscriptions were raised to pay for the initial cost and the result was the immensely successful exhibition of 1851, held in Hyde Park, London. The fair was largely housed in the Crystal Palace, an enormous building of iron and glass, measuring 1,851 by 408 ft. The exhibits were chiefly raw materials, machinery, manufactures, and fine arts. The success of this British undertaking, particularly in advertising British products to the world, encouraged other nations to stage exhibitions along similar lines. Notable successors were the Exposition Universelle of 1855 held in special buildings in the Champs Élysées, Paris; the South Kensington Exhibition of 1862 at London; the Austrian International Exposition of 1873 at Vienna; the Centennial Exhibition of 1876 at Philadelphia; the fourth French International Exposition of 1889, held at Paris and remarkable for the erection of the Eiffel Tower; the World's Columbian Exposition of 1893 at Chicago, whose buildings in Jackson Park marked a new height in grandeur; the fifth French Exhibition of 1899-1900, held in the Champ de Mars, Paris; the Pan-American Exposition of 1901 at Buffalo, N.Y., at which President McKinley was assassinated; the St. Louis World's Fair of 1904; the Panama-Pacific Exposition of 1915 at San Francisco, celebrating completion of the Panama Canal; the British Empire Exposition at Wembley, in 1924-25; the Paris Exposition des Arts Décoratifs in 1925, which created the vogue for "modernistic" art; the Sesqui-Centennial Exposition of 1926 at Philadelphia, and the International Colonial and Overseas Exposition of 1931 held at Vincennes, near Paris. Chicago has planned on a most pretentious scale a Century of Progress exhibition for 1933.

The following table of figures relating to the largest world exhibitions indicates the growth of this institution of trade promotion:

Site	Year	Exhibitors	Attendance
London	1851	13,937	6,039,195
Vienna	1873	25,760	6,740,000
Paris	1889	61,722	32,350,297
Chicago	1893	65,422	27,539,521
Paris	1900	75,531	39,000,000
Wembley (British Empire)	1924-25	27,102,498

WORLD'S COLUMBIAN EXPOSITION. See WORLD FAIRS.

WORLD'S ILLUSION, THE (*Christian Wahnschaffe*), a powerful novel by the Austro-German author, JACOB WASSERMANN; published 1919. Christian Wahnschaffe, the proud, handsome son of a wealthy industrialist, gropes blindly for some truth beyond that which he finds in the utterly futile life of his class. Made to see clearly the depths of misery, Christian gives up his fortune, family and former friends, and devotes his life to succoring the down-trodden. Two outstanding characters are Crammon, the aristocrat, and Eva Sorel, a dancer.

WORLD WAR, THE. On June 28, 1914, a shot was fired in a remote village in the Balkans which culminated in the greatest catastrophe of recorded history. It is obvious, however, that the assassination of an Austrian Archduke would not, of itself, have precipitated a World War. The fundamental causes of this gigantic struggle reach far back into the history of Europe, and it is necessary to understand these underlying causes of international strife in order to appreciate how they led inevitably to the great cataclysm of the World War. Moreover, it will be interesting to consider how far these fundamental causes were eliminated by the settlement which brought the world conflict to a close.

Fundamental Causes. The fundamental causes of the World War may be considered under the following heads: (1) Violation of the principle of nationality; (2) Exaggeration of the principle of nationality; (3) Militarism and the formation of military alliances; (4) International anarchy; (5) Economic rivalry.

The French Revolution and the Napoleonic wars, at the opening of the 19th century, bequeathed to Europe two fundamental ideals, nationalism and democracy. Despite the efforts of the diplomats at the CONGRESS OF VIENNA in 1815 to repudiate these revolutionary principles, they were steadily advanced during the 19th century. The winning of Belgian independence, the erection of national states in the Balkans and most noteworthy, the national unification of Germany and Italy in 1871, illustrate the growth of the ideal of nationality. There still remained, however, at the close of the 19th century a number of peoples in Europe whose national ambitions had not been realized, and the efforts of these submerged national groups to obtain national unity were a constant menace to the peace of Europe. When Prussia defeated France in 1870 the two French provinces of Alsace and Lorraine were annexed to the newly formed German Empire. France regarded the loss of these provinces as a violation of French nationality, and the enmity between France and Germany during the years that followed was in large measure caused by the determination of France to regain the "lost provinces." The Austro-Hungarian monarchy and the Turkish Empire presented flagrant examples of the violation of the principle of nationality. Polish patriots longed for the day when their

disembodied nation would again be united. In short these unsolved problems of nationality were like so much tinder scattered about Europe ready to be ignited when a favorable opportunity came.

The spirit of nationalism when carried to an extreme also endangers international peace. During the 19th century national patriotism was erected into a fetish; indeed in many cases it aroused emotions akin to those formerly associated with religion. People were taught to believe that their particular "kultur" was superior to that of other nations. The doctrine that certain so-called superior races had a mission to perform in "civilizing" the backward peoples of the world became widely held. Glorification of one's own country not infrequently led to contempt for other nations. Such exaggerated national feeling was not conducive to international goodwill.

One of the most important underlying causes of the war was the growth of the spirit of militarism in Europe and the formation of secret military alliances after the Franco-Prussian War. Bismarck, the guiding genius in the unification of Germany, had built a powerful military machine based upon the principle of compulsory military service of all able bodied males. The example of Germany was quickly followed by most of the leading nations in Europe. Great Britain, alone, dispensed with conscription but devoted her efforts instead to the building of a huge navy. Not only did these military and naval preparations place heavy financial burdens upon the nations involved but they also increased the international tension. Although the assertion was usually made that these armaments were intended only for national defense, this term was vague enough to justify any war that a nation might see fit to undertake.

A further menace to European peace came as a result of the formation of secret military alliances among the Great Powers. In 1872 Bismarck drew together the three countries, Germany, Austria-Hungary and Russia, in an informal understanding called the Three Emperors League. The clashing interests of Russia and Austria-Hungary in the Balkans prevented this combination from becoming a permanent alliance. In 1879 Bismarck concluded a definite military accord with Austria-Hungary, and three years later Italy joined the Teutonic powers to form the TRIPLE ALLIANCE. This combination of the three central European powers caused apprehension among the remaining Great Powers, who sought to counteract its influence by means of a new alignment.

First France and Russia, drawn together by mutual hostility to Germany, entered into a "defensive" military alliance in 1894. Great Britain had for centuries pursued a policy of "splendid isolation" and had consistently refused to join permanently any of the continental alliances. As long as she controlled the high seas with her large navy, Great Britain felt secure in her island position from hostile attack. But with the close of the 19th century many British statesmen became convinced that isolation might be splen-

did but was no longer safe. This conviction became more certain when Germany undertook the building of a powerful navy. As a result, Great Britain and France, after adjusting certain long standing disputes, formed an "entente cordiale" in 1904. Although this was not a formal alliance, in practice the two states cooperated and effectively challenged German domination in Europe. In 1907 Great Britain and Russia adjusted their outstanding disputes, and the entente between Great Britain and France was extended to include Russia. See TRIPLE ENTENTE.

In the opening years of the 20th century we see, therefore, the six Great Powers grouped in two opposing military alliances. In these circumstances it was inevitable that diplomatic crises threatening European peace should arise. For a decade before the World War scarcely a year passed without some controversy involving the "prestige" of the opposing alliances, and each crisis left behind it a heritage of bitterness and fear. Several times the rival military alliances had brought Europe to the brink of war; in 1914 they plunged Europe into the abyss.

Had there existed in Europe an effective international organization for the settlement of international controversies and the assurance of national security it is possible that peace might have been maintained. The various European Congresses at Vienna, Berlin and Paris, the informal "Concert" of Europe, the organization of The Hague Tribunal, the large number of arbitration treaties that were negotiated, were all ineffective in securing lasting peace. Rampant nationalism had brought international anarchy in Europe.

The last and probably the most important of the underlying causes of the war was the economic rivalry among the great nations of the world. The Industrial Revolution which began at the close of the 18th century advanced with giant strides during the 19th century. First in England, then in France, the United States, Germany, Japan, Italy and many less important countries, great industrial enterprises were established. The volume of manufactured goods increased each year at a remarkable pace. Keen competition developed among the powerful industrial interests of the various nations in their efforts to dispose of their commodities in the world markets. Large scale industrial development called for great quantities of raw materials, especially coal and iron. Again from the profits of industry surplus capital was accumulated and those who controlled the capital desired to find profitable investments. The struggle for markets, the search for additional supplies of raw materials and the efforts to find profitable investment for surplus capital, brought about a veritable frenzy for colonial expansion. The continent of Africa was parceled out among the imperialist nations of Europe, while large sections of Asia were divided into "spheres of influence" dominated by these same nations. It is doubtful whether the economic resources of some of these colonies and spheres of in-

fluence warranted the effort and money spent in acquiring them; but in the grand scramble for such possessions which marked the last quarter of the 19th century little thought was given to this question. The policy pursued by most nations appeared to be to grab everything possible and determine its value afterward. About one matter there is no doubt and that is that the struggle for colonial possessions contributed largely to national rivalries and international strife.

Immediate Causes. On June 28, 1914, the Archduke Francis Ferdinand and his wife were assassinated in the little town of Sarajevo, capital of the province of Bosnia. The crime was committed by Serbian conspirators, and it was an outgrowth of the enmity that had developed between Austria-Hungary and Serbia because of the annexation of Bosnia by Austria in 1908. Austrian officials declared that the crime had been instigated by high officials in the Serbian Government. This was stoutly denied by the Serbian authorities, but as a result of the disclosures made several years after the war there appears to be some justification of the Austrian charge. In any event Austria-Hungary regarded the crime as a natural result of the Pan-Serbian agitation that had been carried on for years in Serbia and which aimed to detach the South Slav populations of Austria-Hungary from the Dual Monarchy. The Austrian authorities therefore felt justified in taking vigorous measures to crush once and for all the Pan-Serbian agitation. Austria-Hungary did not, however, act hastily. Nearly a month elapsed after the assassination before Austria presented an ultimatum to Serbia. Just what transpired in these critical three weeks between June 28 and July 23 will probably never be fully known to the world. How far was Germany consulted in the preparation of the Austrian ultimatum? The official German documents published since the war indicate that Germany did not advise Austria concerning the nature of the ultimatum and that, in fact, she did not know the terms of the ultimatum until a day or two before it was sent to Serbia. She merely gave Austria a "blank check" and agreed to back Austria in any demands she should see fit to make upon Serbia. If the official records tell the whole story, it is difficult to escape the conclusion that the German authorities were guilty of crass stupidity in giving Austria a free hand in such a critical situation.

On July 23 the Austrian ultimatum was sent to Serbia. It declared that Serbia had violated her promise made in 1909 to renounce her attitude of protest against the annexation of Bosnia and had encouraged an unfriendly propaganda against Austria-Hungary. Austria insisted that Serbia officially condemn this propaganda and express regret at its consequences. The ultimatum then made several peremptory demands upon Serbia, most important of which were that Serbia must suppress all anti-Austrian publications and societies, that it must strike out from text-books used in Serbian schools all matter tending to incite hatred of Austria-Hungary, that it must dis-

miss teachers, civil officials and army officers who were engaged in anti-Austrian propaganda, that it must "accept the collaboration in Serbia of representatives of the Austro-Hungarian Government" in the suppression of subversive propaganda and must allow Austrian judicial officials to take part in the investigation in Serbia of those accused of complicity in the crime at Sarajevo. A full acceptance of these demands was required within 48 hours.

The publication of the ultimatum caused great concern in the foreign offices of all the Great Powers, for it was realized that any move made by one of the Great Powers in the Balkans would precipitate a European crisis because of the clashing interests of the Great Powers in this region. The requests of Sir Edward Grey, the British Foreign Minister, supported by France and Russia, that an extension of the time limit of the ultimatum be granted in order that the diplomats might have time to find a solution of the difficulty, were refused by Austria. Just before the expiration of the 48 hour time limit Serbia replied in a very conciliatory manner. She denied having encouraged the hostile propaganda against Austria and agreed to comply with most of the demands of Austria. The two demands which called for the participation of Austrian officials in Serbia in investigating the crime at Sarajevo and in suppressing hostile propaganda, Serbia declared she could not accept without violating her sovereignty. Nevertheless she agreed to submit these two points either to The Hague Tribunal or to the decision of the Great Powers and to abide by the decision. In France, England and Russia the Serbian reply was regarded as very satisfactory. Even the German Kaiser stated that Austria had won a diplomatic victory and all cause for war had been removed. But the Austrian authorities claimed that the reply was evasive and unsatisfactory and immediately broke off diplomatic relations with Serbia.

It was certain that any hostile move by Austria against Serbia would seriously endanger the peace of Europe. It is true that both Austria and Germany declared that the Serbian dispute was purely a local matter concerning only Austria and Serbia. But it is doubtful that they seriously believed that any war in the Balkans could be localized. The day after the Austrian ultimatum was sent the Russian authorities, assured of support by France whose foreign policy had become much more positive since 1912, declared that "any action taken by Austria to humiliate Serbia could not leave Russia indifferent." Moreover the German authorities stated that "warlike moves on the part of Austria-Hungary against Serbia, would bring Russia into the question and might draw Germany into a war in accordance with her duty as Austria's ally."

It was apparent then that if a European conflagration was to be avoided every effort should be made to prevent the first hostile move by Austria against Serbia. Various proposals were made with a view to finding some solution of the controversy. Mediation between Austria and Russia by the four less directly

interested Powers; mediation between Austria and Serbia by an Ambassadorial conference; direct conversations between Vienna and St. Petersburg, were all suggested and proved unavailing because of the opposition of one or more of the Powers unconcerned.

On July 28 Austria declared war on Serbia, and Russia immediately gave orders for a mobilization of the Russian army against Austria. When it became apparent that all hope of localizing the conflict had vanished, Germany brought pressure to bear upon Austria, urging her to negotiate directly with Russia in the hope of finding some satisfactory compromise. The Austrian authorities declined to listen to these suggestions and determined to make full use of the "blank check" which Germany had unwisely given them.

Events moved rapidly to the final crisis. The war parties in both Germany and Russia assumed control of affairs. The Russian Czar, after some vacillation, submitted to the demands of the military authorities and ordered a general mobilization of the Russian army. Germany regarded this action as a serious menace to her and on July 30 sent an ultimatum to Russia demanding complete demobilization of the Russian army within 12 hours. Upon Russia's refusal to comply with this demand Germany declared war on Russia on Aug. 1. With the realization that war with Russia would certainly involve France, Germany sent a note to France demanding a definite commitment as to French neutrality and indicating that the surrender of the French forts at Toul and Verdun would be required as a guarantee of neutrality. France replied that she would "take such action as her interests might require." Two days later, on Aug. 3, Germany declared war against France.

With the involvement of four of the great European Powers in the war there remained the question of the attitude which would be taken by the two remaining Great Powers, Great Britain and Italy. We have seen that Great Britain's obligations to France and Russia under the Triple Entente merely called for diplomatic cooperation on the part of Great Britain with her continental associates. But strong commitments of a moral character had been made by sanctioning conversations between the military staffs of England with those of France and Belgium looking toward cooperation in case of war and by the naval arrangement whereby the French fleet concentrated in the Mediterranean and the English undertook the defense of the North Atlantic. In the critical week before the outbreak of the war both French and Russian authorities urged Great Britain to declare that if war came she would join France and Russia. They maintained that if Sir Edward Grey would make such a declaration war would be avoided. Such a declaration, they argued, would serve as a check upon Germany and Austria and would compel the latter to accept a peaceful solution of the Balkan crisis. Sir Edward Grey, however, declined to make any definite promise to France and Russia that Britain would support them militarily, and at the same time he

refused to assure Germany that Great Britain would remain neutral even if Germany would agree not to annex any French territory.

When on July 31 war between Germany and France seemed inevitable, Great Britain became alarmed lest one or both of the belligerents should violate the neutrality of Belgium which had been guaranteed by international agreement in the treaty of 1839. Great Britain's concern in this matter was not due primarily to her desire to protect a small nation from aggression but because of the proximity of the Belgian coast to her shores and also because of the important British commercial interests in Belgium. Sir Edward Grey sent notes to both France and Germany inquiring whether they would respect the neutrality of Belgium. France returned a satisfactory reply; but Germany stated that it was doubtful whether she could reply without disclosing part of her plan of campaign. On Aug. 2 the German authorities demanded that the Belgian Government allow German troops to cross Belgium in order to enter France. The Belgian King declined to allow this and called upon the signatories of the treaty of 1839 to protect Belgium. Great Britain promptly sent an ultimatum to Germany demanding assurance that she would not invade Belgium, and when German forces occupied Belgian territory on Aug. 4 Great Britain declared war on Germany. That Great Britain would have become involved in the war irrespective of the question of Belgian neutrality, there is little doubt. On Aug. 2 two days before Germany entered Belgium, Sir Edward Grey had assured the French ambassador that Great Britain would protect the north coast of France from any attack by the German fleet. By this act Great Britain obligated herself to enter the war under certain conditions, and the Belgian issue merely changed a partial entrance into full participation in the war.

War Responsibility. Since the close of the war many volumes have been written by apologists for both sides and by impartial historical scholars with the purpose of determining the relative responsibility of the nations and of their statesmen for the great catastrophe that engulfed the world in 1914. As a result of the publication of the official documents relating to the war in Germany, Russia, Austria-Hungary and, less fully, in Great Britain and France, historical scholars have generally agreed that the indictment drawn in the Versailles Treaty which held Germany and her Allies solely responsible for the outbreak of the war can no longer be maintained. It is probable that none of the statesmen of the Great Powers wanted war. They doubtless realized the frightful losses and terrible suffering that such a war would involve even if they could not foresee the far-reaching political and social changes which the war ultimately brought about. But war came despite the more or less sincere efforts of the statesmen to prevent it. That the statesmen of Austria must be held chiefly responsible for the precipitation of the crisis seems hardly open to question. Their stubborn refusal, up to the

last day of European peace, to allow Austria's quarrel with Serbia to be considered as a European problem cannot be justified. Germany must assume her share of the responsibility because of her foolhardy action in giving Austria a free hand. Neither France nor Russia can be held guiltless, for their statesmen did not act, to say the least, with a singleness of purpose to preserve the peace in the critical days before the outbreak of the war. Sir Edward Grey made sincere efforts to preserve peace but he was not wholly candid with his own Parliament concerning Great Britain's obligations to France. The fact is that the European statesmen in 1914 were held in the grip of a Frankenstein of their own and their predecessors' making. The intricate system of secret military alliances had divided Europe into two hostile groups. The piling up of huge armaments intensified the fear and hatred among the nations. Economic rivalry and national prestige contributed to the international anarchy. No one nation or statesman in Europe was responsible for these conditions and no one statesman nor all combined could control the complex of international rivalries in Europe. It was the European system that precipitated the World War.

Spread of the War. When the World War broke out Italy, as we have seen, was a member of the Triple Alliance. Her association with the Teutonic powers had never been wholly sincere. Austria-Hungary was Italy's natural enemy, for the Habsburg rulers controlled in the Trentino and Trieste regions a large Italian-speaking population. Italian patriots had for many years looked forward to the day when these provinces would become a part of Italy. Under the terms of the Triple Alliance Italy was obligated to support Germany and Austria only in a defensive war. When the war broke out Italy declared that it was not a defensive war on the part of Germany and Austria and therefore she was not obligated to join them. For 10 months Italy remained neutral and then in May 1915, having received guarantees of large territorial rewards at the expense of Austria-Hungary from Great Britain and France, Italy joined the Franco-British alliance.

Far-off Japan saw in the war an opportunity not only to fulfill her obligations to Great Britain under the treaties of 1902 and 1905 but also a splendid chance to advance her national interests in the Far East, and incidentally to square accounts with Germany who had participated in the humiliation of Japan at the close of the Chinese-Japanese War in 1895. Therefore Japan demanded that Germany should turn over to her the leased territory at Kiao-Chau in China. Upon Germany's refusal to do so Japan declared war against Germany on Aug. 23, 1914.

All of the nations in the Balkans ultimately became involved in the war. Serbia, as we have seen, was in from the beginning, and little Montenegro quickly threw in her lot with her neighbor. Turkey had for many years before the war been recognized in diplomatic circles as a protégé of Germany. When the

war broke out Turkey signed a secret treaty with Germany and after hesitating two months openly joined the Teutonic cause. Germany also succeeded in winning to her side Bulgaria after a year's delay, during which time the Bulgarian authorities weighed the relative value to Bulgaria of the offers made by the rival belligerent groups. The other two Balkan states, Greece and Rumania, after a still longer delay joined the Entente alliance. Portugal joined the Entente side in 1916 as a result of her treaty of alliance with Great Britain. First and last, therefore, the whole of Europe except Spain, Holland, the Scandinavian states and Switzerland, was swept into the maelstrom of war.

The United States and the War. Among the people of the United States when news came of the outbreak of war in Europe the immediate reaction was one of bewilderment. Many persons in this country had been deceived by the progress that had been made in the years before the war toward the peaceful settlement of international disputes, and there were few in America who understood the complicated international rivalries in Europe that were destined to nullify the promising advances that had been made in international goodwill. Quite apart from the confused state of the public mind in America, it was natural that President Wilson should follow the traditional policy of this country and proclaim our neutrality. The President's proclamation called upon the country to be "neutral in fact as well as in name." But it was not easy to maintain neutrality "in fact as well as in name" among the heterogeneous population of the United States, in which there were millions of persons who had come, or whose parents had come, from one or another of the nations involved in the war. However loyal these persons were to their adopted country, it was inevitable that their sympathies for the countries from which they had migrated would be deeply stirred. To add to the confused state of the public mind in this country there came from the different belligerent countries official representatives and propagandists who labored to convince the people of America of the justice of their respective causes.

For more than two years the United States maintained its neutral status, but with each passing month it became increasingly difficult to preserve neutrality and at the same time defend American rights. Both belligerent groups desired to obtain from America war supplies and food stuffs and both groups made every effort to prevent their enemies from getting these supplies. Shortly after the war started Great Britain declared a blockade of Germany but found difficulty in enforcing it without interfering with the commerce of the neighboring countries of Holland, Norway, Sweden and Denmark. The United States protested vigorously against the interference by Great Britain with our trade with these neutral countries; but Great Britain, citing the precedent of our own Civil War, insisted upon her right under the doctrine of the continuous voyage to prevent American com-

modities from reaching Germany through the neighboring neutral states. Other controversies with Great Britain involved the use of the American flag by British merchant vessels to avoid attack by German submarines and the opening of American mail destined for European countries.

More serious was the controversy between the United States and Germany concerning the operations of submarines. The peculiar character of these new naval weapons made it difficult if not impossible to use them effectively under the established rules of naval warfare, which required that a merchant vessel could not be sunk without warning and unless provisions were made for the safety of the passengers and crew. Germany determined to disregard these rules and declared that all merchant vessels entering a war zone drawn around the British Isles and along the French coast would be sunk without warning. President Wilson promptly warned Germany of the serious consequences that would result if American lives were lost through the illegal activities of submarine commanders. On May 7, 1915 the sinking of the Cunard Line steamship *Lusitania* off the Irish coast by a German submarine without warning resulted in the loss of over 1,190 lives, of whom over 100 were American citizens. President Wilson immediately called upon Germany to repudiate the action of the submarine commander, to pay reparation for the loss of American lives and property and to give a solemn pledge that such an outrage would not be repeated. For a year communications passed back and forth between Germany and the United States concerning the submarine warfare. Germany defended her violation of international law on the plea that Great Britain had done the same in her blockade of Germany. The United States authorities insisted that violation of international law by one belligerent did not justify similar action by another belligerent when such violation interfered with neutral rights. Finally in May 1916 President Wilson sent an ultimatum to Germany stating that unless she immediately abandoned her illegal submarine campaign the United States would break diplomatic relations with Germany. This brought a satisfactory response from Germany, and for 10 months thereafter there was a lull in the activities of German submarines.

On Feb. 1, 1917 Germany served notice that she proposed to resume unrestricted submarine warfare, justifying her action on the ground that the United States had not forced Great Britain to abandon her illegal blockade of Germany. The German threat brought prompt action from President Wilson. Diplomatic relations with Germany were severed, and when Germany declined to withdraw from the position she had taken President Wilson summoned Congress in special session "to receive a communication concerning grave matters of national policy." On Apr. 2, 1917 the President appeared before a joint session of the two houses and read his historic war message. After reviewing the violation of American rights by Germany and advising Congress to declare that such

actions constituted war against the United States, he then went on to justify our participation in the war on idealistic grounds. He declared that our purpose was "to vindicate the principles of peace and justice in the life of the world as against selfish and autocratic power, and to set up among the really free and self-governed peoples of the world such a concert of purpose and action as will henceforth insure the observance of those principles." He asserted that "the world must be made safe for democracy" and at the same time disclaimed any desire for conquest of material compensation.

The entrance of the United States into the war was greeted with wild demonstrations of enthusiasm by the Entente Allies, for it came at a time when their military situation was desperate. In addition to placing at the disposal of the Allies the vast material resources and fresh man power of America, the intervention of the United States gave to the Allied cause a much needed moral tone which was provided by the idealistic pronouncements of President Wilson.

Influenced by the action of the United States, most of the Central and South American countries either declared war against Germany or broke diplomatic relations with that country. In all 30 nations became involved to a greater or less extent in the gigantic struggle. Truly it was a World War!

On the Fighting Line. At the outbreak of hostilities the German authorities realized the advantage of assuming the offensive. They had to face enemies on both the eastern and western frontiers. Counting upon the slowness with which the Russian military machine could be brought into effective operation, the German military leaders determined to concentrate their efforts in the early weeks of the war on the western front in the hope of delivering a crushing blow to France and then to turn to the task of defeating Russia. On Aug. 4, 1914 the German forces entered Belgium and within a month had swept across Belgium and northern France. Finally checked at the Marne River (*see* MARNE, FIRST BATTLE OF THE) by the superb stand of the French army the Germans retreated to the Aisne River where they established a line of trenches which was extended during the fall and winter of 1914-15 from Nieuport on the English Channel to the Swiss frontier.

While the Germans were making their supreme effort to crush France the Russians with unexpected rapidity advanced into East Prussia and also overran a large part of Galicia, in Austria-Hungary. Additional German forces were sent to the east, and the Russians were defeated with terrible losses at the BATTLE OF TANNENBERG and the Battle of Masurian Lakes.

Overseas, on the other hand, the superiority of the British and French fleets soon made itself felt. German commerce was swept from the sea and her colonies invaded. The effect of the German naval victory off the coast of Chile in the Pacific, in November, was soon dispelled by the destruction of the raiding cruisers off the Falkland Island on Dec. 8. In the meantime, the Japanese who had promptly re-

sponded to their treaty obligations and joined England when the war broke out, attacked Kiaochow, captured it and so destroyed the German power in the Far East.

In 1915 Germany reversed her military strategy, holding the western front and concentrating her efforts against Russia. The result was a crushing defeat of the Russian forces. The German army overran all of Poland, penetrated deep into Russian territory and also forced the retirement of Russian forces from most of Galicia. The western front remained with little change during 1915, despite efforts of the Entente Allies to dislodge the Germans. As a partial offset to the failures of the Allied military operations in 1915 came Italy's entry into the war in May on the side of the Entente. For a year and a half Italian armies engaged large forces of Austrians on the northern frontier of Italy successfully driving them back into Austrian territory till the great defeat at Caporetto in October and Dec. 1917 threw them back on the line of the Piave.

The outstanding military events of the year 1916 were two gigantic offensives, one by Germany around Verdun (*see* VERDUN, SIEGE OF) which lasted from February to July and the other by the Entente Allies along the Somme River (*see* SOMME, BATTLE OF) which extended from July to October. Despite the staggering loss of human life which these tremendous efforts involved, they did not result in any material change in the positions held by the opposing forces on these fronts. In another quarter, however, the Central Powers scored a tremendous success. Persuaded that the victories of Mackensen against the Russians proved the superiority of Germany's military power, Bulgaria joined the Central Powers in October. This immediately exposed the eastern frontier of Serbia to a flank attack. Further, to make the destruction of Serbia more inevitable still, the German command sent Mackensen to the Danube. Against the formidable attack of German-Austrians along the line of the Morava from Belgrade, and the Bulgars' invasion from the east, the Serbs were utterly helpless. Thousands of their army were captured and the remainder made its way to the Adriatic to embark in Allied ships. Montenegro too was conquered by Jan. 1916. Only the landing of a formidable Allied force at Salonika kept the victors from occupying all of the Balkans to the Aegean and forcing Greece to join them.

Despite the apparent military advantage that the Teutonic powers had at the end of 1916 the German leaders realized that the longer the war lasted the less was their chance of final victory. By 1916 Germany and her Allies had mobilized their full man power and material resources. Germany found it increasingly difficult to replace the huge losses in men and material. The Allied blockade became more effective as the war developed, thereby depriving Germany of access to sources of supply from neutral countries. If Germany could bring the war to a close before further large losses weakened her military strength and while she still held large areas of Allied territory

with which she could bargain at a peace conference, it would be decidedly to her advantage. This situation accounts for the offer made by the German authorities in Dec. 1916 to enter a peace conference. This offer the Allies declined because they realized the advantage which Germany would have in such a conference with so much Allied territory in her hands for trading purposes. Furthermore, the preponderance of the Allies at sea was fully established by the BATTLE OF JUTLAND fought off the coast of Denmark on May 31, 1916. From the beginning of the war, the German high-seas fleet had concentrated at its base behind Helgoland, the Kiel Canal giving it the means of commanding both the Baltic and this part of the North Sea. From this as a vantage ground, repeated raids by cruisers and submarines were projected, resulting in great loss to Allied shipping, notably the sinking of the *Lusitania* off the coast of Ireland, on May 7, 1915, with the loss of 1,198 lives. On May 31, 1916, a British battle-cruiser fleet encountered the German high-seas fleet and engaged it in the formidable naval Battle of Jutland, which lasted till darkness when the Germans withdrew before the full weight of the British dreadnoughts could get into action. The losses were about equal; but, although the Germans gave a remarkable account of themselves, they remained bottled up, and the British kept command of the seas, tightening their blockade of German European trade at the approaches to the Channel, the North Sea and the Mediterranean, and taking over full control of the trade of European neutrals.

To break this cordon, the Germans in Feb. 1917, resumed unrestricted submarine warfare which they had agreed, after the sinking of the channel packet *Sussex* on Mar. 25, 1916, to stop upon certain conditions. Germany's decision to reopen the submarine campaign led directly not only to the entry of the United States into the war, but to a submarine campaign against commerce which increased the loss of Allied tonnage at a rate to threaten all possibility of winning the war. More than 6,600,000 tons were sunk during 1917. Only by world wide commanding of ships and a feverish program of building was this menace finally overcome toward the end of 1917.

In the meantime, the area of the war on land had also been extended. On Aug. 27, 1916, Rumania, encouraged by the apparent success of the Allies on the west front, and by a revival of the Russian offensive under Gen. Brusilov, declared war on the Central Powers and sent her armies into Transylvania to free their fellow Rumanians in Hungary. From the military standpoint, it was a great strategic blunder, for before the year was out, Mackensen with his victorious troops and his Bulgar allies, fresh from crushing Serbia, drove the Rumanians back from the south while Falkenhayn closed in from the north and west. On Dec. 6 Bucharest was in the hands of the Germans, and all the vast resources of grain, cattle, oil and rolling stock of the country became available to them. The Middle European corridor was thus widened and cleared from the Rhine to the Black Sea.

The year 1916 also marked serious reverses to the British in Mesopotamia, where Gen. Townsend was forced to surrender with 13,000 men to a superior Turkish force at Kut-el-Mara on Apr. 29. The loss of prestige to Great Britain throughout Mohammedan lands was unfortunate and by many thought irredeemable. Fortunately, the next year brought a reversal of the relative position. Bagdad was captured by the British in March, and Palestine invaded by an expeditionary force from Egypt. It took Ascalon and Jaffa on its march to Jerusalem, which surrendered, on Dec. 19, 1917. Early in the summer (June) Greece too had been brought into the Allied camp by the overthrow of King Constantine.

With the year 1917 the war entered a new phase. Besides the curbing of the submarine two events early in the year were destined to have a profound effect upon the character of the war and upon its ultimate outcome. These events were the Russian Revolution in March, and the entrance of the United States into the war in April. The second of these events has already been described.

The Russian Revolution, like most of the revolutions in the 18th and 19th centuries, began as a bourgeois or middle class movement. The Provisional Government that was set up after the deposition of the Czar was composed largely of men drawn from the professional and intellectual classes. These classes desired to set up in Russia a constitutional monarchy or a republic but did not wish any far-reaching social and economic changes. But the peasants and workers in Russia were concerned more with economic and social than with political reforms. Alongside of the Provisional Government there sprang up throughout Russia local councils of peasants and workers called Soviets. For a time the Provisional Government and the Soviets worked together in harmony. But it soon became evident that those who advocated radical social changes in Russia were rapidly gaining strength. In August, Kerensky, the leader of the moderate Socialists became the head of the Provisional Government. Other more radical leaders who had been in exile returned to Russia after the deposition of the Czar.

Among these leaders were Nicolai Lenin and Leon Trotzky. They appealed to the peasants and workers to put the radical communist of Bolsheviks in control and promised the Russian people two things, peace and land. In Nov. 1917 the moderate Kerensky Government was overthrown and the Bolsheviks took control. The Bolshevik leaders took immediate steps to take Russia out of the war. They issued a call for a general peace conference to formulate a peace based upon the Russian formula of no annexations and no indemnities and the right of all peoples to self-determination of their political allegiance. The Entente Allies and the United States declined to accept the Russian invitation, and then the Bolshevik leaders entered into separate peace negotiations with Germany. Russia finally withdrew from the war in Mar. 1918.

The Russian Revolution brought to an end all serious fighting on the Eastern Front, and when Russia finally withdrew from the war many German divisions were released for service on the Western Front. It was not until the fall of 1917 that American forces in large numbers began to arrive in France. The fate of the Entente Allies depended upon the ability of the United States to land sufficient troops in France to balance the German forces transferred from the Eastern Front. With the opening of spring in 1918 it was clearly to the advantage of Germany to begin offensive operations in France before more thousands of American troops arrived there. From March to July the German army struck a series of terrific blows along various sectors of the Allied line. On July 15, 1918 the tide turned. Marshal Foch, who had been placed in supreme command of the Allied forces, assumed the offensive, and from then to October the Allies pressed the Germans steadily back across France into Belgium. On Oct. 12 the German authorities, realizing that further resistance was hopeless, appealed to President Wilson for an armistice. After a month's negotiations the armistice was signed on Nov. 11 and the four years of frightful warfare came to an end.

The Peace Conference. Soon after the entrance of the United States into the war President Wilson came to be regarded as the spokesman for the Allied nations. In a number of addresses, delivered during the last year of the war, he attempted to formulate the conditions upon which he believed a just and lasting peace could be made. Most notable of these addresses was that made on Jan. 8, 1918, in which he proclaimed the famous **FOURTEEN POINTS**. These called for the abolition of secret diplomacy, freedom of the seas, reduction of armaments, adjustment of colonial claims in the interest of the peoples involved, evacuation and restoration of occupied territories, cession of Alsace-Lorraine to France, transfer to Italy of Italian speaking populations of Austria-Hungary, reestablishment of Poland, autonomy for subject nationalities in Austria-Hungary and Turkey, and, finally, the establishment of a league of nations.

It would have been difficult under the most favorable circumstances to have realized this idealistic program of President Wilson, and at the close of the war circumstances were far from favorable. The losses and suffering during the four years of war had aroused a deep feeling of hatred among the peoples of all of the nations involved. All of the idealism and the spirit of self-sacrifice that had been shown during the war vanished with the armistice. From the victorious nations came loud cries for vengeance upon the defeated nations whom they held responsible for precipitating the terrible catastrophe. Moreover, the various Entente Allies demanded the fulfillment of the obligations contained in the secret treaties that they had agreed to early in the war, obligations which in many cases ran counter to the principles enunciated by Mr. Wilson. Handicapped by this outburst of bitterness and of national ambitions, the

delegates of 32 nations that had been associated in the war against the Central Powers gathered at Paris in Jan. 1919, to solve the problems of peace settlement far more complicated and difficult than had confronted any peace conference in the past.

President Wilson went to Paris at the head of the American delegation. He was received with loud acclaim by the peoples of all of the Allied countries. But when he attempted to formulate his ideal principles into concrete proposals he failed to satisfy the national ambitions of the victorious nations. As a consequence his popularity in Europe quickly waned.

On one point President Wilson's heart was set, and that was the organization of a league of nations with a specific covenant which should be incorporated in the peace treaties. With considerable reluctance the delegates of the other nations accepted the President's proposal, and the Covenant of the LEAGUE OF NATIONS was written into all of the treaties drafted by the peace conference. Having accomplished the thing which he regarded as the most essential, Mr. Wilson felt obliged to make concessions in regard to the territorial adjustments and financial arrangements that were included in the treaties.

For five months the delegates at the Paris Conference labored to reconcile the conflicting interests of the nations represented. Only when they had completed the task were the German delegates called in, and despite their protests they were required to sign the treaty. Separate treaties were signed with the other Teutonic allies, Austria, Hungary, Bulgaria and Turkey.

These treaties brought about far-reaching changes in the territorial possessions of the European states. Germany lost Alsace-Lorraine to France, two small districts to Belgium, a part of Schleswig to Denmark, all of Posen, a strip extending to the Baltic Sea, and part of Silesia to Poland. All of the German colonies were taken from her and assigned as mandates to various Allied powers, under the supervision of the League of Nations. The Austro-Hungarian monarchy was completely disrupted. Large parts of the former Habsburg territory were assigned to the neighboring states of Rumania, Serbia, Poland and Italy, the new state of Czecho-Slovakia was created, and the remnants of the empire were divided between the two independent states of Austria and Hungary. Bulgaria was required to surrender considerable territory to Yugoslavia and Greece. Turkey was allowed to retain her territory in Europe, chiefly because the Allies could not agree what to do with it if the Turks were expelled; but a large part of Asiatic Turkey was organized as mandates under the League.

In addition to the territorial losses the defeated nations were required to submit to drastic restraints upon their military powers and economic life. Germany was virtually disarmed. Her army was limited to 100,000 men, conscription was abolished within her territories, rigid limitations were placed upon German manufactures of munitions, her western frontier was demilitarized, her naval power was limited

to six battleships, six light cruisers, and 12 torpedo boats, without any submarines. Similar restraints were placed upon the military power of the other defeated nations.

More serious were the economic burdens placed upon Germany. She was required to surrender virtually her whole merchant marine to the Allies and to build additional ships for the Allies to replace Allied shipping sunk by German submarines. She was obliged to deliver large quantities of coal to France, Belgium and Italy. The administration of the rivers Elbe, Oder, Danube and Rhine was placed in the hands of international commissions under the supervision of the League. The important coal area in the Saar Basin was also placed under the jurisdiction of the League, and the mines were turned over to France for a period of 15 years. Finally a huge bill for reparations was exacted from Germany. The total amount of reparations was subsequently fixed by an Allied commission at \$33,000,000,000.

To assure the fulfillment of the terms of the treaty an Allied army was to occupy the German territory on the west bank of the Rhine as well as the bridgeheads at Coblenz, Cologne and Mainz. This occupied territory was to be evacuated over a period of 15 years provided that Germany loyally met her obligations under the treaty.

Aftermath of the World War. The World War surpassed any previous conflict in recorded history in the number of nations and men involved, in the loss of human life and the destruction of property, in the huge financial obligations that were placed upon the people of the warring nations, and in the significant political and social changes that it inaugurated.

Nineteen nations were actively engaged in the war, while 11 other nations declared war but did not participate actively in the military operations. Only 19 nations in the world remained neutral, and even these were profoundly affected by the gigantic conflict. Sixty million men were in the armies of the combatants, and of these over 8,000,000 were killed. How many millions more died of starvation or disease due to war conditions will never be known. The property loss caused by the war has been estimated as more than \$36,000,000,000, and the money expended by the principal belligerents in the prosecution of the war amounted to \$186,000,000,000. A large part of this huge financial expenditure was covered by loans to be passed on as a burden to future generations.

Politically and socially the post-war world presented striking contrasts to the world of 1914. The principle of nationalism that had grown steadily during the 19th century was strikingly advanced as a result of the war. Four non-national empires, Germany, Russia, Austria-Hungary and Turkey, were disrupted, and from the ruins there emerged nine new national states.

The increase in the number of new nations brought about a change in the relative importance of states.

Prior to the war the six Great Powers dominated the European situation. The other states of Europe played an insignificant part in the determination of international questions. After the war a number of states of the second rank, such as Poland, Czecho-Slovakia, Rumania and Yugoslavia, played an important, if not decisive part, in international affairs.

The war brought a remarkable increase in the number of republics. Virtually all of the new states of Europe were organized as republics, and of the older states, Germany and Russia were transformed from monarchies into republics.

The democratic ideal made important gains in the post-war world. All of the new constitutions drafted for the European states granted not only manhood but woman suffrage as well. Moreover during the war period women were given the vote in Great Britain and the United States. On the other hand democracy was challenged in a number of European states by the rise of dictatorships. It is not possible as yet to determine whether these dictatorships are temporary expedients, improvised to grapple with social and economic conditions brought about by the war, or whether they are a permanent challenge to the democratic ideal.

Out of the war came a number of important developments in the social order and economic organization of the nations of the world. Of these changes the one that has attracted greatest attention and interest has been the remarkable effort made in Russia to inaugurate a social and economic order based upon the dogmas of Marxian Communism. Whatever may be the outcome of this unique experiment it is certain to affect profoundly the life of the Russian people, and its influence, in all likelihood, will not be confined to Russia. In fact the effects of these new social and economic ideals have already been far-reaching and significant. In nearly all of the leading countries of the world the traditional *laissez-faire* capitalism has been definitely challenged. On all sides we see governments taking an increasingly active part in regulating, if not actually conducting, business enterprises. Social legislation, while not a new phenomenon, has come to be accepted as an important function of the political authorities in most countries. In short, 19th century economic individualism was seriously weakened by the World War and its results.

Out of the war came the first real organization of the nations of the world on an international basis. It would be difficult to conceive of a more unpromising situation in which to launch an experiment in international organization than that which prevailed at the end of the World War. Four years of embittered warfare had intensified national hatreds. International cooperation under these conditions seemed hopeless. Moreover, two of the largest nations of the world, the United States and Russia, did not become members of the new world organization and their abstention materially lessened its effectiveness. Finally there was bequeathed to the League of Nations at its inception a number of extremely difficult

international problems that the diplomats at the peace conference had failed to solve. That the League was able to survive under all these handicaps is perhaps the most convincing proof of the need of such an international organization.

Although the League of Nations has not solved all of the perplexing international problems that have confronted it during the first decade of its existence, it has served a useful purpose in providing a great international forum in which the representatives of 56 nations of the world gather yearly. It has provided a valuable method for crystallizing world opinion on international questions and it has successfully established a number of important international agreements. With all of its limitations the League has provided an international order which is a notable advance upon the international anarchy that prevailed in the world before the war.

Of the many serious problems that the League was called upon to solve, none offered greater difficulty than the question of the reduction of armaments. The Covenant of the League provided for a League commission to study the question of armaments and to make recommendations looking to a general reduction. This commission made little progress at first because a number of European nations were unwilling to consider the reduction of their military and naval forces until additional guarantees for security were provided. Efforts to provide this additional security by strengthening the powers of the League were unsuccessful. The Treaty of Mutual Assistance submitted by the League Council in 1923 and the Geneva Protocol of 1924 were both rejected. One important cause for international friction was, however, removed by the Locarno Treaties of 1925 which placed under international guarantee the frontier between Germany, France and Belgium. These treaties also led to Germany's admission into the League of Nations.

The first definite accomplishment in armament limitation came not through the activities of the League but through the initiative of the United States. In 1921 President Harding invited the leading naval powers of the world to a conference at Washington. (See WASHINGTON CONFERENCE.) Agreements were reached at this conference which called for a substantial scrapping of naval tonnage by the three leading naval powers, Great Britain, the United States and Japan, and which also provided a fixed quota of capital ships for those three countries as well as for France and Italy. The success of the Washington Conference stimulated popular interest in disarmament and led to further efforts to extend the scope of these agreements.

In June 1927 the French Government proposed a pact of perpetual friendship between France and the United States, in which both nations should agree never to resort to war for the settlement of any disputes that might arise between them. To this suggestion the United States authorities replied that they felt it would be desirable to invite all of the prin-

cial nations of the world to adhere to such a declaration. This proposal was accepted by France and in Aug. 1928, the representatives of 15 states met at Paris and signed the so-called Pact of Paris. This agreement provided that the signatories "condemn recourse to war for the solution of international controversies, and renounce it as an instrument of national policy in their relations with one another" and further that they agree that the settlement of all disputes "of whatever nature or of whatever origin they may be, which may arise among them, shall never be sought except by pacific means." The Pact of Paris did not outlaw war nor deprive any nation of its right of self-defense, but its acceptance by 56 nations of the world did make aggressive war less likely. It was hoped also that it would satisfy the demand that had been made for additional security and thereby pave the way for further disarmament.

Upon invitation of the British Government a conference of the five chief naval powers that had participated in the Washington Conference met at London in Jan. 1930, to consider the extension of the limitation of naval armaments to the types of ships not regulated by the Washington Conference. (See LONDON NAVAL PARLEY.) The three chief naval powers, Great Britain, the United States and Japan, were able to reach an agreement; but France was not willing to accept equality with Italy, as she had done at the Washington Conference, and these two powers did not sign the London Conference treaty.

Ten years of study of the far more complicated problem of the limitation of land armaments by the League Commission resulted in no definite action by the nations of the world, but there was some hope that the first step looking to a solution of this thorny problem would be taken at a conference to be held in Feb. 1932.

Viewed in retrospect the record of the decade following the World War aroused both hope and discouragement. Ten years after "the war to end war," the nations of the world were still burdened with huge armaments. Narrow and exclusive nationalism had increased rather than diminished as a result of the war. Economic imperialism still flourished as a menace to world peace. Many of the unreasonable territorial and economic provisions of the peace treaties still stood in the way of any real friendship between victors and vanquished in the war. The absurd reparations levied upon Germany, coupled with the huge inter-allied war debts, greatly retarded the economic recovery of the world.

On the other hand popular interest in world peace and disarmament was never before so widespread. The League, the Locarno Treaties, the Paris Pact the Washington Conference and the London Armament Conference assuredly did not bring the millennium, but they did make aggressive war less respectable and they kept the ideal of world peace constantly before the peoples of the world. For thousands of years the accepted method for the settlement of disputes between nations has been an appeal to arms.

Long established traditions cannot be uprooted in a day or a year. If the experiences of the World War and the 10 years that followed have measurably advanced the ideal of peaceful settlement of international disputes, then the terrible sacrifices of the war will not have been wholly in vain.

N. P. M.

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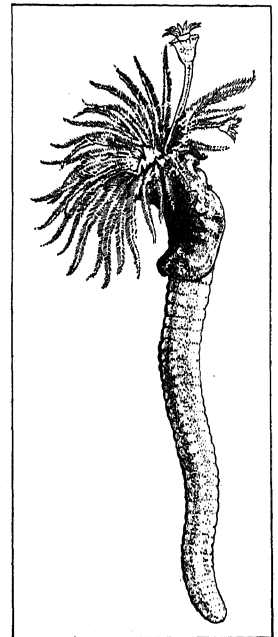
WORLDLY WISEMAN, MR., in Bunyan's *PILGRIM'S PROGRESS*, a character representing the sin of worldliness, who attempts to draw Christian away from his course towards the Celestial City.

WORM GEARS. See GEARS AND GEARING; POWER TRANSMISSION, MECHANICAL.

WORMS, popularly nearly every kind of long thin animal, if it has only very short legs or is legless, may be called a worm. The slow worm is a lizard, the blind worm an amphibian, and caterpillars, often spoken of as worms, are insect larvæ. Even the legendary dragon was sometimes named the worm.

True worms may be best described as generally elongate, bilaterally symmetrical, boneless and legless animals, which often have an under surface adapted for crawling. They belong to several phyla of animals, and include many dangerous parasites, as well as man's good and familiar friend, the earthworm. The most important groups are the flatworms, Platyhelminthes, such as tapeworms and flukes, the Nemathelminthes, like the threadworms (*Nematoda*) and hairworms (*Nematomorpha*); the annelids such as the earthworms (*Megadrili*), marine bristle-worms (*Polychaeta*) and leeches (*Hirudinea*); and the Trochelminthes like the little rotifers. Isolated groups are the Nemertines, the arrow-worms (*Chaetognatha*), and the Phoronidea. See also EARTHWORM; FLUKES; PARASITES; ROTIFERS; TAPEWORMS; THREADWORM; TRICHINA; TRICHINOSIS.

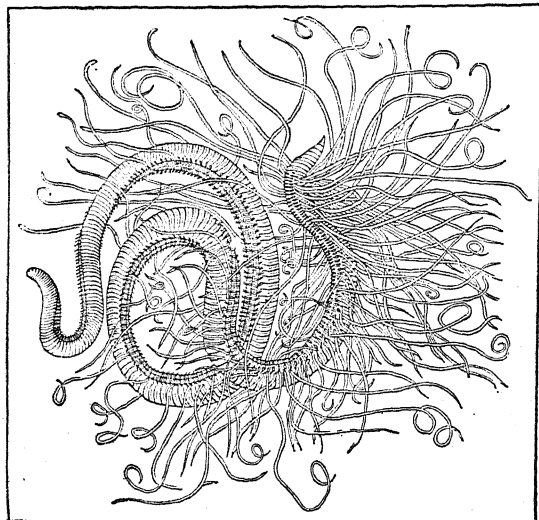
WORMS, a city in the German state of Hesse on the Rhine, about 25 mi. south of Maintz. It has many medieval buildings, including the 11th-century cathedral with graves of rulers of the Frankish-Salic



COURTESY AMER. MUS. OF NAT. HISTORY

SERPULID WORM (*Hydroides hexagonus*) MODEL

dynasty, St. Martin's, Our Lady's, St. Paul's, Trinity, St. Magnus, and the former Bishop's Court, seat of the Diet in 1521. There are also the Dominican Abbey, the Jewish Bath, and many modern buildings.



CIRRATULID WORM
Cirratulus grandis

Worms, the old Borbetomagus, capital of the Vangions, was the seat of a bishop from the 4th century to 1906. An imperial residence in the 8th century, it was ruled by the bishops in the 11th. In 1200 the citizens gained their independence and supported the emperors against the princes. Worms is famous for the Imperial Diet summoned in Apr. 1521 at which MARTIN LUTHER appeared before the Emperor Charles I to defend the Protestant theses. It was a free city until the French régime and, after many vicissitudes, including its almost complete destruction by fire in 1689, fell to Hesse-Darmstadt in 1815. The city produces leather, filters, slate, asphalt, paints, furniture, soap and wine. Aided by the shipping facilities it trades in wine, leather, grain, lumber and coal. Pop. 1925, 47,015.

WORMS, CONCORDAT OF, the agreement reached in 1122 between the Emperor, Henry V, and Pope Calixtus II which closed the controversy over investiture of bishops. The dispute was of long standing and had led to the crisis between Pope Gregory VII and Emperor Henry IV and the humiliation of the latter at Canossa. The difficulty was general throughout Europe but most critical in the Holy Roman Empire where the bishops administered exceptionally broad lands and, as appointees of the Emperor, supported him in his relations with the pope. The difficulty arose from the fact that bishops were at once prelates of the Church and great feudal lords by virtue of the Church lands which they administered. The question involved election as well as investiture. In the Concordat it was agreed that bishops should be elected by the members of the Cathedral chapter, but in the presence of the emperor

or his representative. The Emperor agreed further to abandon his claims to invest bishops with the ring and crozier, symbols of spiritual authority. The Pope, in turn, agreed that the Emperor alone could invest a bishop with his lands. The Concordat closed the controversy centering technically about investiture but failed to establish a lasting agreement between Church and Empire. Their disputes broke into open war under the Emperor Frederick I (Barbarossa) and Frederick II.

WORMS, THE DIET OF, an outstanding event in the history of the Reformation. After MARTIN LUTHER had been condemned by Pope Leo X and had burnt the papal bull of excommunication, his case would probably have been summarily disposed of by Charles V had not the monk of Wittenberg already had strong support. The new Emperor therefore summoned him to appear before the diet at Worms and gave him a safe-conduct for his journey. To the friends who protested against his going, Luther declared, "I would go even if there were as many devils there as tiles on the house tops." When he appeared before the diet, Apr. 17, 1521, he was asked to recant, but insisted that he should be proven wrong by the Scriptures. Thus he invoked the authority of the Bible as against the traditional authority of the Church and took his stand firmly upon this issue. Charles allowed him to leave in accordance with the terms of the promise given him, but obtained from the diet an edict that placed him under the ban of the Empire. On his way home, Luther was seized by order of his prince, Elector Frederick of Saxony, and carried to the Wartburg for protection. There he made his translation of the Bible into German.

WORMS, TREATMENT FOR. See ANTHELMINTHICS.

WORMSEED, a name applied to any plant with seeds possessing anthelmintic properties, especially to the Levant wormwood (*Artemisia santonicum*), the dried flowerheads of which yield santonin, and the American wormseed or Mexican tea (*Chenopodium ambrosioides* var. *anthelminticum*). The latter, which is a native of tropical America, widely naturalized throughout the United States and Canada, is grown commercially in Maryland for the production of wormseed oil, an official vermifuge.

WORMWOOD (*Artemisia Absinthium*), a much branched, slightly shrubby perennial of the composite family, called also absinthium. It is a native of Europe and northern Asia sometimes escaping from gardens in North America. The stems, which grow 2 to 4 ft. high, bear finely divided, white-silky leaves with an intensely bitter, somewhat aromatic taste, and numerous small greenish or yellowish flowerheads in leafy clusters. The leaves and flowering tops were formerly highly valued in medicine for their aromatic, tonic and anthelmintic properties. Wormwood is now used chiefly as an ingredient of absinthe. Various other species of *Artemisia* are also known as wormwood.

WÖRTH, BATTLE OF, an engagement fought on Aug. 6, 1870 during the Franco-Prussian War, between the German army under the Crown Prince and the French under Marshal MacMahon, near the Alsatian village of Wörth. The battle began and continued with a series of accidents and misapprehensions. As a result of the German victory Alsace was overrun and Strassburg invested while the French retreated through the Vosges to join the army of reserve at Nancy.

WORTHING, a municipal borough and seaside resort of Sussex, England, situated between a fine beach and the sheltering Chalk Downs, 6½ mi. southwest of London. The remains of a villa and pottery works attest to Roman occupation, and in the mother parish of Broadwater the cruciform church contains Norman work. The modern town, however, shows no traces of antiquity in its library, hospitals, splendid marine parade and promenade pier. Worthing's industries include the hothouse cultivation of fruits and flowers. Pop. 1921, 37,050; 1931, 46,230.

WOTTON, SIR HENRY (1568-1639), English poet and diplomat, was born at Boughton, Malherbe, Kent, Mar. 30, 1568. He was educated at Oxford, traveled abroad for several years, and in 1595 entered the service of the Earl of Essex, supplying him with news from abroad. Involved in the downfall of Essex, Wotton went to Italy and from there took a journey to Scotland to warn James of a plot against his life. Recalled to England after James's accession, he was ambassador to Venice from 1604-24, and from then until his death was provost of Eton. In the posthumous *Relinquiae Wottonianae*, which contains the memoir by Izaak Walton, appear Wotton's two immortal lyrics, *The Character of a Happy Life* and *On his Mistress, the Queen of Bohemia*. He died at Eton, early in Dec. 1639.

WRANGEL, PIOTR NIKOLAYEVICH, Baron von (1877-1928), Russian soldier, was born at Novo Alexandrovo, Kovno, Aug. 27, 1877. After professional activity as a mining engineer in Siberia, Wrangel took part as a volunteer in the Russo-Japanese War, after which he became an officer of Cossack cavalry, and subsequently commanded a division in the World War, where he demonstrated exceptional courage and initiative. After the November Revolution of 1917, he associated himself with the White Army Leaders, first with Kaledin, and after the latter's suicide, with Alexeyev and Denikin. When the White offensive crumbled in 1919 almost within striking distance of Moscow, Wrangel was called upon for assistance, but as a result of friction with Denikin he later retired to Istanbul. Upon Denikin's retirement, however, he named Wrangel as his successor to the supreme command of the now demoralized White troops. During the early months of 1920, Wrangel succeeded in restoring this haggard force to a semblance of efficiency, but after peace was concluded between Poland and the Soviets, and allied aid was no longer forthcoming, he abandoned the resistance in the Crimea in Oct. 1920, and was able to

evacuate his army and a large number of refugees to Istanbul and the Balkans. Wrangel made heroic efforts to organize a new existence for these refugees, but was seriously handicapped by lack of financial support. Withdrawing from his command under French pressure, he eventually resumed in 1926 the life of a private citizen in Brussels, where he died, Apr. 25, 1928. S. H. C.

WRANGELL ISLAND, in the Arctic Ocean, situated about 400 mi. northwest of Bering Strait. It is 70 mi. long and 30 mi. wide. The interior is mountainous, the highest point, Berry Peak, reaching to 2,500 ft. above sea level. The Russian explorer F. von Wrangell, after whom the island is named, in 1824 sought in vain to find it after Siberian peasants had reported its sight. T. Long, an American whaler, sailed along its southern shore, but the first man to land on it was Captain C. L. Hooper of the U.S. Navy who took possession of the island for the United States in 1881.

WRANGELL, a port and incorporated town in southeastern Alaska, in the first judicial division, situated on Wrangell island, at the mouth of the Stikine River, 150 mi. southeast of Juneau. The traffic of the harbor in 1920 amounted to 37,137 short tons worth \$3,715,100. The town has saw mills as well as canneries and commercial fisheries. There are mineral deposits in the vicinity. The remains of the old Russian fort, established about 1833, still stand. Pop. 1920, 821; 1930, 948.

WRANGELL, MOUNT, an active volcano in the Wrangell Mountains of Alaska, situated in the great bend of the Copper River. There are higher peaks in the group but Mt. Wrangell (14,005 ft.) is the only active volcano. Its outlines are produced by masses of lava and volcanic mud piled up on the earlier surface. The line of perpetual snow begins at about 6,500 ft., and the great flat cone is a glistening ice field broken here and there by a smoking rock. On its western face numerous jets of steam issue from vents and fissures, and on its eastern slope flows Nabesna glacier, an ice river 50 mi. long. The crater intermittently sends out rolling columns of smoke 3 mi. high. It was named for Baron von Wrangell, governor of the Russian colonies in Alaska in 1831-36.

WRASSE, a name of spiny-rayed fishes of a large family (*Labridae*) found chiefly in warm waters, where they live close to the surface among rocks and coral reefs. The majority of wrasses are characterized by compressed, scaly bodies, an extended dorsal fin, and thick, folded lips. Special teeth, suitable for crushing shellfish and mollusks line the pharyngeal bones. In America, the wrasses are represented by the tautog (*Tautoga onitis*), occurring on the middle Atlantic coast and of some value as a food fish, and the cunner, the ladyfish, and the doncella. Many of the wrasses are brightly colored.

WRECK, in maritime law, a ship which has become wholly unnavigable, or unable to pursue the voyage without repairs exceeding half the value. At COMMON LAW, goods cast upon land by the sea after

shipwreck are called wreck. They were forfeited to the Crown or to persons having a franchise of wreck. In the United States, where wreck is not claimed by the owner within a year, or some period specified by statute, it becomes the property of the state.

WREN, SIR CHRISTOPHER (1632-1723), British architect, was born at East Knoyle, Wiltshire, Oct. 20, 1632. Educated at Oxford University, he attained distinction as a mathematician and astronomer. In 1662, he was invited by the dean of the chapter to make a survey of the old St. Paul's Cathedral, which vitally needed repair. His interest in architecture already aroused, he devoted himself to it completely, and on invitation of Charles II, he drew plans for the restoration of St. Paul's, but before the work was begun the great Fire of London (1666) almost completely destroyed it; efforts at repair proving vain, Wren was chosen to rebuild the church, which stands now as his masterpiece. He was also employed to make designs for the fifty other ruined churches, and he also drew a new city plan, which was abandoned only because of difficulties arising from the ownership of the land. He was knighted in 1673, and was elected president of the Royal Society, and sat in Parliament from 1685 on. Among his famous buildings still standing are the London churches of St. Mary-le-Bow, St. Michael's, and St. Bride's; the Sheldonian Theatre, Ashmolean Museum, Tom Tower of Christ Church, and Queen's College Chapel, Oxford; the Trinity College Library and Pembroke Chapel, Cambridge. His tomb in St. Paul's Cathedral bears the famous epitaph, in Latin, "If you seek his monument look about you." He died in London, Feb. 26, 1723.

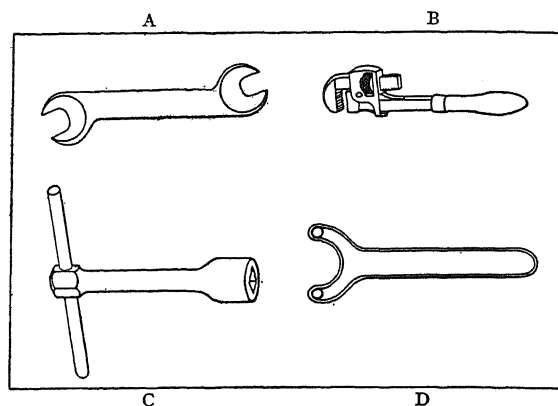
WREN, one of a numerous family (*Troglodytidae*) of small song birds closely allied to the mockingbirds and creepers. There are fully 250 species and varieties, occurring most numerous in the American tropics; comparatively few are native to the Old World. They are from 4 to 8 in. long and have slender, somewhat curved bills, short wings, short tails usually carried erect, and plain, mostly brownish plumage. Most wrens are active, irritable and aggressive in disposition, and, though often chattering and noisy, are excellent songsters. Making their home in buildings, shrubberies, cat-tail swamps, crevices of cliffs, piles of rock or in clumps of cactus, they live on or near the ground and feed chiefly upon insects.

About 25 species and varieties of wrens are found in the United States and Canada. The best known is the common house wren (*Troglodytes aedon*) of eastern North America, breeding in southern Canada and the northern states and wintering in the South Atlantic and Gulf states. It is about 5 in. long, with reddish-brown plumage, with dusky bars, and brownish white below. Coming fearlessly about houses and grounds, it nests in buildings, bird boxes, holes in trees or other convenient inclosures. It lays five to nine pinkish-white, finely speckled eggs, often rearing two or three broods in a season. Other note-

worthy eastern species are the Bewick, winter, marsh and Carolina wrens; representative western species are the rock, canyon, and cactus wrens. The Carolina and the cactus wren are fine songsters. See also CANYON WREN; ROCK WREN.

A. B. J.

WRENCHES, tools used to turn bolts, nuts, pipes and rods. "Straight" wrenches are made solid with U-shaped opening to fit a bolt head or nut. Adjustable wrenches have one movable jaw and will fit nuts of different sizes. Some are made with serrated jaws



TYPES OF WRENCHES

A, 22½° angle wrench; B, Stillson pipe wrench; C, Socket wrench; D, Pin face wrench

so as to grip a round object, such as a pipe. Wrenches are also made with ratchet heads so that they can be "backed up" without turning the nut or bolt. Socket wrenches are widely used, the wrench head being cup-shaped. The illustrations show some of the many different types of wrenches. See also MONKEY WRENCH.

F. H. C.

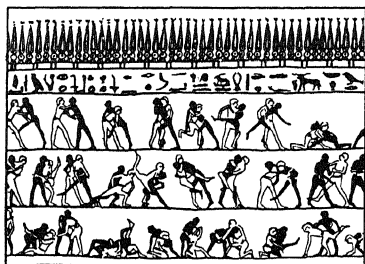
WRESTLING, in sport, the struggle between two contestants to throw each other to the ground. It is one of the oldest and most universal of sports. There are several styles, with various regulations. In the



GREEK WRESTLER TRYING TO FORCE HIS OPPONENT TO HIS KNEES

Lancashire or catch as catch can style, most popular in the United States and England, any hold that is not foul is permitted, and the winner must force the loser's shoulders to touch the ground. In the modern Greco-Roman style, which bears no resemblance to the true classic wrestling, all holds below the waist are barred. Modern European wrestlers are trained in this so-called Greco-Roman style.

It was developed to an art in India, and is one of the most popular sports in Japan. Wrestling has always been popular in the country districts of England and was a favorite sport of the pioneer woodsmen of



COURTESY EGYPTIAN EXPLORATION SOCIETY

AN EGYPTIAN WRESTLING MATCH
From wall paintings of the tombs at Beni
Hassan, Egypt

America. Professional wrestling, like professional boxing, has many adherents, and thousands throng to the championship matches. An odd development of professional wrestling has been the change in tactics brought about by the recent entrance to professional ranks of several college football stars. These men introduced a preliminary series of football rushes and tackles as a means of temporarily stunning or disabling their opponents, thus making it easier to clasp on a final and winning hold. Whether these new methods will endure is yet to be seen.

WREXHAM, a municipal borough of Denbighshire, north Wales, situated 12 mi. southwest of Chester and about 163 mi. northwest of London. It was originally Saxon, and to the southeast was once the most ancient monastery in Britain, established before 120. The Church of St. Giles, 14th to 16th century, is one of the "Seven wonders of Wales"; it has a decorated interior, and a 16th century paneled tower with a celebrated carillon. Wrexham is the seat of the Roman Catholic bishop of Menevia. With the 19th century development of Welsh coalfields the town grew industrially, and, although suffering the post-World War depression of all Wales, it carries on with its foundries and collieries. There also is some interest in agricultural fairs and marts. Pop. 1921, 18,703; 1931, 18,567.

WRIGHT, SIR ALMROTH EDWARD (1861-), British bacteriologist, was born in Middletown, Tyas, Yorkshire, Aug. 10, 1861. He received his preliminary education at Dublin University, and his scientific and medical training in the University at Leipzig, Strassburg and Marburg. He was demonstrator of pathology at Cambridge in 1887; lectured in physiology at Sydney in 1889; was professor in the Army Medical School at Netley from 1892 to 1902, and was then appointed professor of experimental pathology in the University of London. He was also principal of the institute of pathology and research at St. Mary's Hospital. Wright was the first to describe the function of calcium salts in the coagulation of the blood and devised a coagulometer for estimat-

ing coagulation time. He was responsible for making vaccination against typhoid practicable, having inoculated over 3,000 soldiers in India and the entire British force in the South African War. Wright was also interested in the preparation of other vaccines and did considerable experimental work in bacterial infection and in measuring the protective substances in the blood. He is author of treatises on antityphoid inoculation and immunization. M.F.

WRIGHT, CARROLL DAVIDSON (1840-1909), American statistician and economist, was born at Dunbarton, N.H., July 25, 1840. He served in the Civil War, rising from private to the rank of colonel in the Union Army. In 1865 he was admitted to the bar and in 1871-72 served in the senate of Massachusetts. During 1873-85 Wright held the appointment of chief of the Massachusetts Bureau of Labor Statistics. In 1885 he was appointed first head of the U.S. Bureau of Labor, holding this appointment until 1902 when he became president of Clark College. Wright lent his support to the system of collective bargaining, urged the sliding-scale principle of wage adjustment and materially improved the working conditions of industrial employees. His published works include *The Industrial Evolution of the United States*, *Outlines of Practical Sociology* and *The Apprenticeship System in its Relation to Industrial Education*. He died in Worcester, Mass., Feb. 20, 1909.

WRIGHT, FRANK LLOYD (1869-), American architect, was born at Richland Center, Wis., June 8, 1869. He studied civil engineering at the University of Wisconsin in the years 1884-88, but dissatisfied with academic standards left before taking his degree. For six years thereafter he studied under LOUIS H. SULLIVAN, who exerted a powerful influence upon the younger man in his teachings of the correlation of form and function in buildings. In 1903 Wright began practice for himself and entered the field of domestic architecture, one largely untouched by Sullivan. Wright developed a type of simple, relatively bare house which he considered suitable to the geographical conditions of the Prairie States. Herein he proved to be one of the founders of modernism in architecture, although his work was almost completely ignored in America until its further development in Europe. When this style was brought back from Europe Wright declared it to be a hopeless misunderstanding and disavowed it completely. Wright's most famous building is, perhaps, the Imperial Hotel, Tokio, which withstood the great earthquake.

WRIGHT, HAROLD BELL (1872-), American novelist, was born at Rome, N.Y., May 4, 1872. He studied at Hiram College, O., and later became a landscape painter. Ordained to the ministry in the Christian Church, he held various pastorates until 1908, when he abandoned the ministry for a literary career. Wright's novels were extremely popular and include *The Shepherd of the Hills*, 1907, *The Calling of Dan Matthews*, *The Uncrowned King*, *The Winning of Barbara Worth*, 1911, *The Eyes of the World*,

When a Man's a Man, The Re-Creation of Brian Kent, 1919, *God and the Grocery Man*, 1927, and *Exit*, 1930.

WRIGHT, ORVILLE (1871-), American airplane inventor, was born at Dayton, O., Aug. 19, 1871. He was educated in the public schools, and at the age of 19 joined his brother, Wilbur WRIGHT, in operating a bicycle shop. The two brothers became interested in aviation, and following a series of experiments with a wind-tunnel, designed to determine the "lift" of varying pressures on plane surfaces, they built a heavier-than-air machine, that flew successfully at Kitty Hawk, N.C., Dec. 17, 1903. When his brother went to Europe in 1908 to demonstrate the machine to representatives of foreign governments, Orville remained in the United States to meet the terms of a government contract calling for a plane capable of flying one hour with a passenger. The first demonstration, Sept. 17, 1908, resulted in an accident, in which Lieut. Thomas E. Selfridge, was killed. However, the following year Wright successfully fulfilled the government requirements in a flight on July 27. A few days later, he flew a distance of 10 miles, from Fort Meyer to Shuter's Hill, near Alexandria, Va., in 14 mins., 40 sec., attaining an average speed of 42½ miles per hour. In 1913 Orville Wright was awarded the Collier Trophy for his invention of the automatic stabilizer. For his pioneer contributions to the science of aeronautics he was decorated by the governments of the United States and France, and was also awarded the Langley, Elliott Cresson, John Fritz and John Scott medals, and in 1909 the gold medal of the French Academy of Sciences. In 1917 he was commissioned major in the Aviation Corps, U.S.A. After the World War he devoted himself chiefly to aeronautical research.

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WRIGHT, SILAS (1795-1847), American statesman, was born at Amherst, Mass., on May 24, 1795. He graduated from Middlebury College in 1815, was admitted to the Vermont bar in 1819, and began practicing law in Canton, N.Y. From 1823-27 he was in the state senate, and in 1827 was elected Democratic member of Congress. From 1828-33 he was comptroller of New York state and then elected to the United States Senate, 1833-44, where he supported President Jackson, voting for the sub-treasury system and the annexation of Texas. In 1844, as a member of the "Albany Regency" group, he was elected governor of New York. He died in Canton on Aug. 27, 1847.

WRIGHT, WILBUR (1867-1912), American inventor, was born near Millville, Ind., Apr. 16, 1867. He attended public school. The gliding feats of Otto Lilienthal in Germany aroused his interest, and with his younger brother, ORVILLE WRIGHT, he invented a system of glider control, the basis of the present-day aileron operation. In 1901 the brothers erected a wind-tunnel in their Dayton, O., bicycle-shop, and obtained reliable data on the lift and drag of plane surfaces at various angles. On the basis of this research they

constructed the first motor-driven airplane, which with its 12 h.p. engine weighed 750 pounds, and demonstrated it successfully at Kitty Hawk, N.C., on Dec. 17, 1903. In 1905 the inventor succeeded in circumventing in part the dangerous "tail-spin," and on Oct. 5, 1905, sustained flight for 38 mins., 3 secs. In 1908 he went to Europe to demonstrate the plane to foreign governments. He astonished European spectators by successful flights near Le Mans and at Pau, and on Dec. 31, 1908, established a new duration record of 2 hrs., 20 mins., which feat won him the Michelin trophy. Returning to the United States in 1909, Wright on Oct. 4 of that year flew from Governor's Island, in New York harbor, up the Hudson River to Grant's Tomb and return, covering 20 miles in 33 mins., 33 secs. On Oct. 9, 1909, Wright established a record speed of 55.82 miles an hour in a flight demonstration before Army officers at College Park, Md. He died of typhoid fever at Dayton, May 30, 1912.

WRIGHT, WILLIAM ALDIS (1836-1914), English author and editor, was born in 1836. He was a graduate of Trinity College, Cambridge, becoming its librarian, and from 1888-1912, its vice-master. In collaboration with William George Clark he edited the *Cambridge Shakespeare*, published in 1863-66, and the *Globe Shakespeare*, 1864. Wright also edited some of the works of Francis Bacon, Edward Fitzgerald, Roger Ascham, John Milton and with J. Eastwood compiled *The Bible Word-Book*. He died at Cambridge, May 19, 1914.

WRIST, the junction of the forearm and hand. The wrist-joint is participated in above by the lower end of the ulna and the cartilaginous disc covering the lower end of the radius; below by three of the carpal bones; navicular, lunate, and triangular. It is strengthened by four ligaments: one on either surface, and one on either side. The many tendons passing over the wrist-joint also strengthen the articulation. Since the shape of the joint surfaces are oval, with the transverse axis considerably the longer, there can be no rotation, only motion of the hand forward and backward, or from side to side.

Dislocation of the wrist-joint is rare, because it is well supported by tendons and ligaments, and the slight movement between the small bones of the hand allows for considerable shock.

WRISTON, HENRY MERRITT (1889-), American educator, was born in Laramie, Wyo., July 4, 1889. He was graduated from Wesleyan University, Conn., 1911 and 1912, and took his doctor's degree from Harvard in 1922. From 1914 until 1925 he taught history at Wesleyan, becoming a professor in 1919. In 1925 he was elected president of Lawrence College. He served as assistant manager of the Connecticut State Council of Defense in 1918, and in 1923-24 was Albert Shaw lecturer at Johns Hopkins University. His publications include *War Chest Practice* and *Executive Agents in American Foreign Relations*.

WRITER, one who prepares material to be printed in newspapers, periodicals and books, in order to

communicate his thoughts and feelings to the reading public. The writing profession includes many specialties, depending upon the field of content, the form of writing employed, or the particular part of the process of preparation for publication with which the writer is specially concerned. Thus a writer may specialize as a collaborator, translator, historian, biographer, essayist, humorist, playwright, poet, short story writer, novelist, or as a specialist on newspaper staffs as REPORTER, re-write man, correspondent, feature writer, critic or columnist.

WRITING, recording words and ideas by means of symbols which convey the meaning of the speaker or thinker to others without oral communication. It seems to have originated when primitive man began to express his inborn talent for imitation by graphically reproducing the animate or inanimate objects of his surroundings. Mnemonic devices, such as knotted cords, sticks, notches, etc., were superseded in the upward trend of human civilization by pictographic designs (*see* PICTOGRAPH) representing, at first accurately and later symbolically, concrete objects (man, wife, child, house, cow, sheep), movements (legs in motion, bent body, open mouth), abstract ideas (as a star representing divinity or sovereignty) and very often whole narratives. Standardization of pictographic script gave rise to the development of the IDEOGRAM, i.e., a simplified pictograph which in turn was followed by phonetic writing, first in syllabic symbols and finally in alphabetic characters (*see* SPELLING; ALPHABET), although it is by no means certain that these were everywhere the successive stages of the history of writing, i.e., that one form necessarily developed from the other. While EGYPTIAN used all three types in writing, CUNEIFORM or linear script never succeeded in developing an alphabet, remaining throughout its long history essentially an ideographic and syllabic script. The materials used in writing naturally differed with geographical location. While stone was universally employed, the Egyptians also availed themselves of papyrus, the Mesopotamians, of clay, and others, of wax, potsherds and skins. *See also* INSCRIPTIONS; PALAEOGRAPHY. I. M.

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WRIT OF ASSISTANCE (Colonial era), a warrant enabling the holder, in search of goods not declared at customs or other contraband, to search any house or ship, break down doors, open trunks and boxes, and seize goods at will. With the accession of King George III, the collectors of customs in New England applied for new writs; the merchants brought the issue before the Chief Justice of Massachusetts, Thomas Hutchinson. Jeremiah Gridley, the King's advocate, argued that the question was narrowly one of the jurisdiction of the Superior Court; that whether writs of assistance were compatible with the liberties of British subjects was solely for Parliament to judge. For the merchants Oxenbridge Thacker replied, from

a legalistic point of view; and James Otis, Jr., boldly appealed to guarantees of civil liberty and principles of right higher than statutory authority. These replies made so great an impression upon the popular mind that Hutchinson hesitated to act, and referred the question to England. After it had been decided there that the colonial court had the power, the writs were issued, and used regularly to the outbreak of war. Two notable instances of their use were in the seizure of smuggled wine in Philadelphia, Mar. 1769, followed by mob violence upon the customs officer; and in the attempt to confiscate smuggled wine in the house of Capt. Daniel Malcolm of Boston, Sept. 1766, which attempt was thwarted by a mob.

WRONG, GEORGE MACKINNON (1860-), Canadian educator, was born in Ontario, Canada, June 25, 1860. He was educated at the University of Toronto and at Wycliffe College. Wrong took orders in the Church of England in 1883 but later turned his interests to educational work. In 1894 he succeeded Sir Daniel Wilson as professor of history in the University of Toronto; he resigned in 1927. His published works include: *The British Nation; A History*, 1903; *The Fall of Canada*, 1914; *The Conquest of New France*, 1918; *Washington and his Comrades in Arms*, 1920, and *The Rise and Fall of New France*, 1928.

WROUGHT IRON, as defined by the Committee on Nomenclature of the American Society for Testing Materials, "is a ferrous material, aggregated from a solidifying mass of pasty particles of highly refined metallic iron, with which, without subsequent fusion, is incorporated a minutely and uniformly distributed quantity of slag."

Wrought iron, one of the earliest used metals, is produced by a process known as puddling. The special feature of puddling is the formation of highly purified iron into a spongy or porous mass which allows a second non-metallic substance, ferrous silicate (usually referred to as slag), to penetrate or be absorbed in the interstices of the porous spongy metal mass. Upon being compressed and worked by hammering or rolling, the non-metallic slag component is drawn out into tiny filaments of microscopic size which gives a pronounced fibrous structure to wrought iron, a characteristic not found in any other metal. When fractured, the material exhibits its fibrousness in a most marked manner compared with the crystalline or granular fracture of other metals.

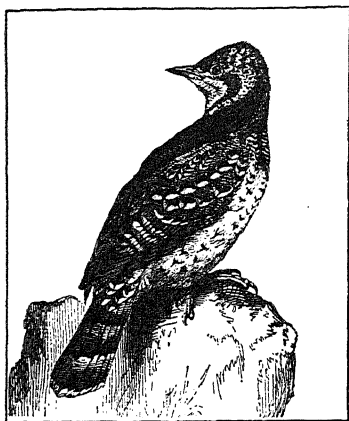
The ferrous silicate slag component is a very vital and essential feature of wrought iron. It produces a high degree of toughness, acts as a flux in welding, and, due to its extreme inertness, confers added corrosion resistance. Wrought iron, therefore, finds its chief use where these attributes are desirable or necessary.

For many years the production of wrought iron has been confined to the output of small hand-worked furnaces limited to masses of 200 or 300 lbs. In recent years, successful methods have been developed for increased production of wrought iron, and the

most noteworthy attainment in this direction is a process developed by James Aston by which individual masses of four tons or more can be processed compared with 200 or 300 lbs. masses from hand-puddling furnaces.

E. B. S.

WRYNECK, a genus (*Jynx*) of small Old World woodpeckers so-called from their curious habit of extending the neck and twisting the head when disturbed. They range in length from 6 to 8 in. and



WRYNECK
Jynx torquilla

have soft brownish-gray plumage finely marked above with brown and black. Because of their soft, flexible tails, which are too weak to support them, they do not climb about tree trunks like the true woodpeckers. The common wryneck (*J. torquilla*) is widely distributed in Europe and Asia, wintering in northern Africa, but the remaining species are found in Africa south of the Sahara.

WRY-NECK, or **TORTICOLLIS**, spasm of the sternocleidomastoideus muscle, which is the large oblique muscle of the side of the neck. As a result of the contraction, the muscle stands out from the neck, the head is pulled down on the affected side, and the face turned toward the sound side. The acute form is the result of local exposure to cold. The chronic form is due to the formation of scar tissue in the sternocleidomastoid, as a result of faulty development or injury. The spasmodic type is nervous origin.

The acute form is self-limited, the chronic type requires division of the muscle, and the spasmodic type sometimes calls for severance of the eleventh cranial nerve.

WU, C. C. (1886-), Chinese statesman, born in Kwangtung province. He received the degree of LL.D. from London University in 1911, and was a barrister-at-law for a time. In 1915 he entered the Ministry for Foreign Affairs, since which time he has been active in China's diplomacy, having served as delegate to the Paris Peace Conference, 1919, Minister for Foreign Affairs in the Canton Government, 1924, Minister of Foreign Affairs in the Nationalist Government at Nanking, 1927-28, and Minister to the United States, 1929-31. When the break between Canton and

Nanking came in 1931, Wu resigned his position at Washington, returned to China to side with the Canton group and became governor of Kwangtung province. He is the son of Wu Ting-fang, one of China's prominent diplomats of the 19th century.

WUCHOW, a treaty port and the principal distributing center in Kwangsi province, southern China. It stands on the banks of the West River at its meeting with the Fu or Kuei River, about 200 mi. from Canton and is frequently flooded at the rising of the waters. Chief exports are indigo, timber, oil, hides and live stock. Wuchow was opened to foreign trade by a special article of the Burma Convention. Its natural advantages as a port between the rich coast cities of Hong Kong and Canton and interior centers of Kwangsi made the city important as a junction. Pop. 1929, 77,353.

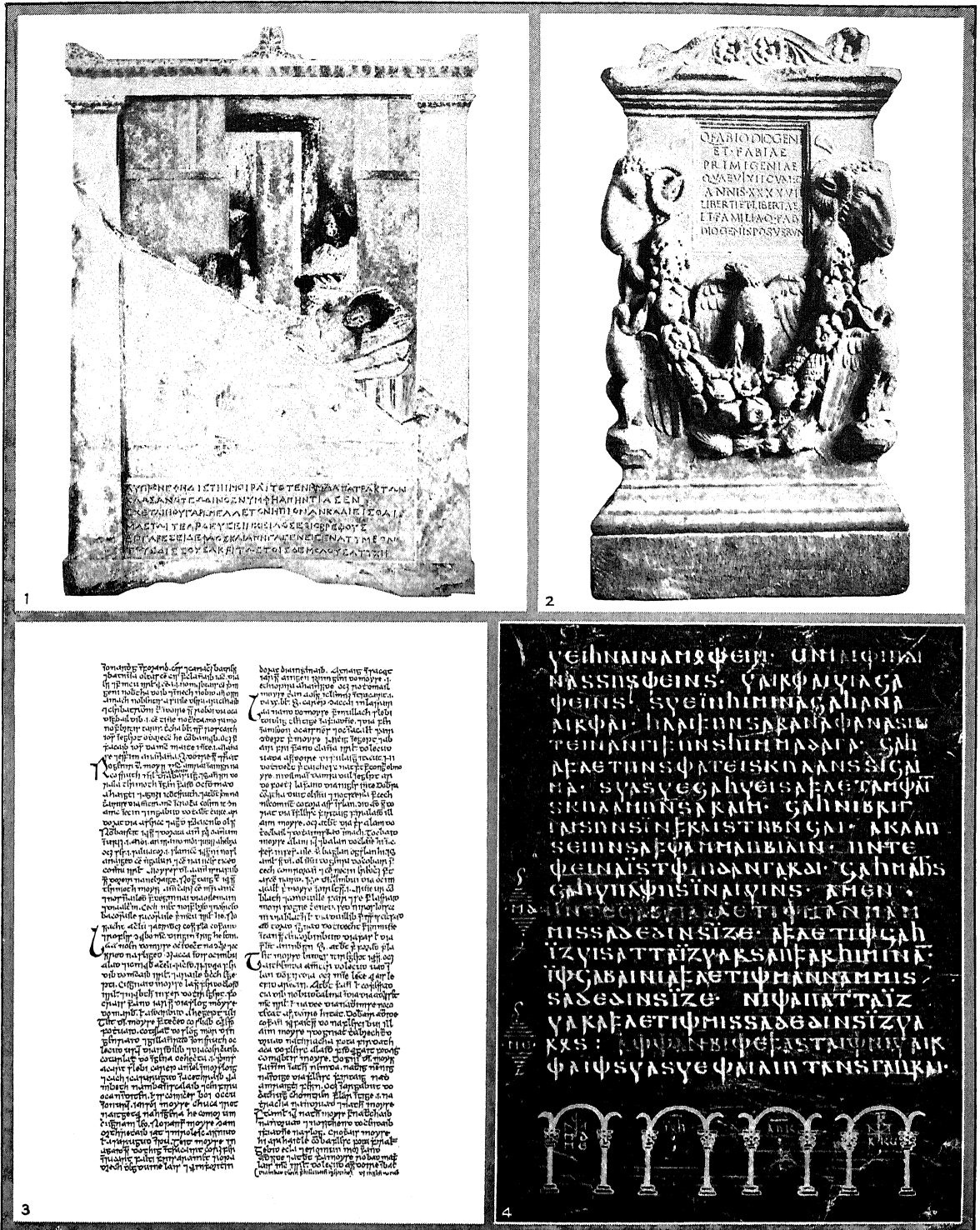
WUHU, a treaty port and rice distributing center on the south bank of the Yangtze River in Anhwei province, China. Leading exports are rice, eggs and albumen. The city has candle and soap factories. Foreign trade was opened in 1877, and since that time ocean steamers have ridden up the Yangtze and docked at especially constructed wharfs allowing them to be close to the land. Known in ancient times as Chui-Tzu-i the city later became Wuhu. Periodical floods have worked havoc. The district suffered during the ravages of the Tai Ping Rebellion in the middle of the 19th century. Pop. 1929, 130,706.

WULFENITE, a fairly common ORE of molybdenum which occurs in the oxidized portions of veins carrying MOLYBDENITE. It is usually found with ores of gold, copper, silver, lead and zinc. In color, wulfenite varies from yellow through orange to red and brown, and may be gray or white. It is translucent. In composition, it is the molybdate of lead, and crystallizes in the TETRAGONAL SYSTEM.

Wulfenite is mined in Arizona, and is also known in Nevada, Utah, New Mexico, and in Europe in Hungary, Germany and Austria. It is also found in Australia. Molybdenum is used in alloy steels, electrical apparatus and certain dyes. See also WEATHERING; ORE DEPOSITS.

WUNDT, WILHELM MAX (1832-1920), German philosopher and psychologist, was born at Neckarau, Baden, Aug. 16, 1832. He studied medicine at Tübingen, Heidelberg and Berlin, but soon reached out in other directions. After spending 11 years on the faculty at Heidelberg he became professor of philosophy at Leipzig in 1875. Here Wundt founded the first clinical laboratory for experimental psychology, and worked out a system of psychology and physiology, based upon the work of ERNST WEBER, GUSTAV FECHNER and Helmholtz. He established a general comprehensive philosophical treatment of all the sciences, their factual accomplishments as well as their concepts, and exerted a marked influence upon the general philosophical ideas of his time. Wundt died near Leipzig on Aug. 31, 1920.

WUPATKI, a national monument containing the Citadel and Black Falls groups of prehistoric ruins,



1, 2. COURTESY METROPOLITAN MUSEUM OF ART; 4. LOUIS H. GRAY, ESQ.

THE WRITTEN CHARACTERS OF ANCIENT PEOPLES

1. Greek. Marble gravestone of Hedisti (250-200 B.C.). 2. Latin. Marble gravestone to a freedman and freedwoman of Cumae (1st century A.D.). 3. Irish. A page from the *Leabhar Breac*, a collection of pieces in Irish and Latin,

Dublin, 1876. 4. Gothic. A page from the *Codex Argenteus*, a manuscript of the Gospels (5th-6th centuries A.D.). Part of this manuscript, transcribed by Ulfilas in silver and gold on purple vellum, is in Uppsala University, Sweden.

comprises 2,234 acres in north central Arizona. It was established Dec. 9, 1924. The buildings are believed to have been built by ancestors of the Hopi Indians. In the two groups, there are ruins of about 35 buildings which apparently were one, two and three stories in height and contained as many as 20 rooms. Action of the elements has reduced some of the ruins to mere heaps of clay and stone. The monument is approximately 30 mi. by motor from Flagstaff, Ariz., which is on the Atchison, Topeka and Santa Fé Railroad and the National Park-to-Park Highway.

WUPPERTAL, a German city in Rhenish Westphalia, situated about 19 mi. east and north of Düsseldorf on the Wupper River. It is a new municipality, having been formed by the combination of Elberfeld, Barmen and other neighboring cities; it is 52 mi. in circumference.

The old section of Elberfeld has narrow, crooked streets, but the newer districts have wide thoroughfares. The most notable old building is the Reformed Church of 1690 with its Romanesque apse of the 13th century. The museum in the old town hall has a collection of valuable paintings and porcelain. Elberfeld was first mentioned in 1176 and received a municipal charter in 1610. The city was founded by weavers, and to-day it has famous textile mills and important clothing industries; it also produces paper, leather goods and beer. Pop. 1925, 167,577.

Barmen comprises several settlements grown together to form an irregular city. It has little of historical interest, but there are a number of large modern buildings. Barmen was mentioned as a settlement as early as the 11th century, and by the 16th century, yarn-bleaching, the chief industry, was well-established. As early as the 17th century "Barmen goods" were being exported to the West Indies, America, England and countries on the continent of Europe. The city is now a leading center for the manufacture of artificial silk. Barmen became a municipality in 1808. Pop. 1925, 187,099.

WÜRTTEMBERG, a free state of Germany, the third state in area and, in 1925, the fourth in population. It is bounded on the east, southeast and northeast by Bavaria, on the west, northwest and southwest by Baden, on the south by Hohenzollern, which it almost surrounds, and by Lake Constance. The southwest embraces part of the Black Forest, the southeast, the Algauer Alps; the south is part of the Alpine foreland, reaching to Lake Constance. The northern part of Württemberg is lower, but hilly. Total area, 7,530 sq. mi. Neckar, Schwarzwald, Jagst and Donau (Danube) are the divisions of the state.

The chief rivers are the Neckar and the Donau with their numerous tributaries. The Tauber River crosses the north tip and flows into the Main. The southern part is drained by the streams flowing into Lake Constance. Only the Neckar is navigable. The climate in the lower country to the north, on Lake

Constance and in the Neckar Valley, is milder than in the mountain regions and in the Black Forest.

Württemberg has a university at Tübingen, a technical institute with the rank of a university at Stuttgart, an agricultural institute, an academy of fine arts, a handicraft school and music conservatory. The lower schools also are numerous. Württemberg was the first state in the world to introduce compulsory education.

Of the 1,538,079 wage earning people in 1925 49.7% were engaged in agriculture and forestry, 31.1% in industry and trades, 10.5% in commerce and transportation. Of the entire area, 64% is under cultivation. The chief agricultural products are hay and potatoes; the chief industrial goods, cotton textiles, clocks, shoes, metal and wooden goods, machinery and musical instruments. Beer, wine and spirits are manufactured. There is some salt and iron mining.

Württemberg became a state in Nov. 1918, and the following year adopted a constitution giving supreme power to a landtag elected by the people. Of the 2,580,235 inhabitants in 1925, 68% were Protestant, 30.9% Catholic and 0.4% Jews. Of the population, 13.3%, 341,967 people, live in STUTTGART, the only large city.

WURTZ, CHARLES ADOLPHE (1817-84), French chemist, was born at Wolfisheim near Strasbourg, Nov. 26, 1817. After studying medicine at the University of Strasbourg, he took charge of the chemical studies there in 1839. In 1846 he became head of the laboratories of the École des Arts et Manufactures at Paris, in 1851 professor at the Economic Institute, Versailles, and in 1853 professor of organic chemistry at the Sorbonne and of toxicology at the École de Médecine. From 1866 to 1876 he was dean of the medical faculty. Wurtz was one of the ablest workers of his time upon problems of organic chemistry, advancing theoretical knowledge of the structure of the alcohols, ammonia salts, and esters. He died at Paris, May 12, 1884.

WÜRZBURG, a city in northwestern Bavaria situated on both banks of the Main River about 50 mi. northwest of Nürnberg. It was formerly the capital of the prince-bishopric of Würzburg. The chief part of the former fortress was the residence of the bishop from 1261 to 1720. The old city is surrounded by a wide garden boulevard. Among the 36 churches, the cathedral, founded in 862 and rebuilt in 1042, with the superb Schönborn Chapel and graves of prince-bishops, is the most noteworthy. The Deutschhaus Church and St. Mary's Chapel, two fine examples of Gothic architecture, the latter with 20 statues dating from the 15th century, and the church on the fortress, the oldest in Franconia, are of interest. The superb Baroque palace of the prince-bishops, built by Balthasar Neumann, with sumptuous halls and great gardens, the university building, the rathaus, monuments and fountains add to the city's beauty. Walter von der Vogelweide was buried in 1230 in the new minster, which also contains the remains of St. Kilian.

The city produces machines, notably rotary presses, pianos, paper goods and chemicals. It trades in wine, lumber, barley and chemicals. There are good harbor facilities and a flying field. A bishopric in 741, Würzburg soon attained importance and was the seat of many imperial diets. Its greatest days were in the 16th century, though it flourished again in the 18th under the bishops of the house of Schönborn. Pop. 1925, 95,113.

WUSIH, one of the leading industrial cities of China, situated on the railroad between Shanghai and Nanking in the fertile, lake-dotted plains of Kiangsu province. Its name meaning "no tin" came from rumor in ancient times that the mountains outside of the city had metals. None were found. Still a walled city, Wusih has cement roads, foreign goods and large factories. Silk filatures predominate among the modern plants but there are also soap, cotton, flour, bean oil and cement mills. Rice and wheat are grown in the rich soil and silk worms raised in large numbers. Canals connect Wusih with other cities in the Kiangsu district. The unusually productive land worked by poor tenants of large landholders made the city in 1929 and 1930 center of Communist unrest and internal discontent. Large groups of students, who have studied abroad, live in Wusih and direct its modernization. More than half of the rapidly growing population of the city is said to be made up of industrial workers. Pop. 1928 est. 225,000.

WUTHERING HEIGHTS, the only published novel by Emily Brontë (*see* BRONTË FAMILY). This profoundly tragic story, with the scene laid in the gloomy moorland country of northern England, deals with a fierce love which, through being thwarted, turned to hatred. Heathcliff, an orphan who has been raised at Wuthering Heights by the Earnshaw family, becomes bitter against all the world when Catherine Earnshaw, whom he has loved since childhood, is married to Edgar Linton, a neighbor of Thrushcross Grange. Inwardly raging, he spitefully hastens to marry Isabel, Edgar Linton's sister. From this point the story deals with the tortures which Heathcliff inflicts upon Isabel until he kills her, and of the revenge which he then wreaks upon Catherine, the daughter of the older Catherine whom he had loved. This story is narrated by Nellie, an old woman who has served at both Thrushcross Grange and Wuthering Heights. The novel was published in 1847.

WYANDOT, the name given to a group of Huron of the Iroquoian linguistic stock and forming a part of that federation. They were known also as Wendat, which is the source of their present name. In the 18th century they migrated from their original home in New York to Ohio and Michigan where the name Wyandot became fixed. In 1842 they were removed to Kansas and in 1867 to Ottawa co., Okla., where they now live, adopting white customs.

WYANDOTTE, a city of Wayne Co., southeastern Michigan, situated on the Detroit River, 5 mi. south of Detroit, of which city it is a residential suburb.

Transportation facilities include the Michigan Central, the New York Central, the Detroit, Toledo and Iron-ton and the Detroit and Toledo Shoreline railroads and bus lines. Limestone and salt deposits are found in the surrounding district. The manufactures include conversion of salt into its various by-products, such as caustic soda, soda ash, lye and baking-soda, compression gaskets for steam and internal combustion engines, gas stoves and ranges. In 1929 the value of manufactured products was about \$34,000,000; the retail trade amounted to \$13,487,119. The first Bessemer steel and first steel rails made in America were produced in Wyandotte; and also the hopper-bottom or "unloader" type of freight vessels. Wyandotte occupies the site of an ancient Indian village called Maguaga, the inhabitants of which were known as Wyandots. The town was settled about 1820, incorporated as a village 34 years later and in 1867 received a city charter. Pop. 1920, 13,851; 1930, 28,368.

WYANDOTTE CAVE, a large limestone cave situated in Crawford Co., southern Indiana, 5 mi. northeast of Leavenworth. This cave is next in size to the MAMMOTH CAVE in Kentucky, the largest known. The entrance is about 200 ft. above the Blue River. Explored portions of the cave constitute over 25 mi. of chambers, galleries and avenues containing a display of stalactites and stalagmites excelling anything known in the United States in number and variety of shape and coloring. The most impressive sights of the cave are Monument Mountain which rises 175 ft. in a room called Rothrock's Cathedral and the Pillar of the Constitution, a large stalagmite 75 ft. in circumference.

WYATT, SIR THOMAS (1503-42), English poet, was born at Allington Castle, near Maidstone, Kent, probably in 1503. He entered Cambridge at 12, and traveled abroad. Handsome, brilliant, skilled in affairs, he gained favor at court, and became High Marshal of Calais. He is supposed to have been Anne Boleyn's lover before her marriage to Henry VIII. For a time he was imprisoned, but after Anne's death was released and sent on foreign missions. Again imprisoned on the downfall of Thomas Cromwell, he was again restored to favor, given lands, and elected to Parliament from Kent. Wyatt, as the older man, probably preceded Surrey in the use of the sonnet form. He also wrote satires and other kinds of verse. His poetry was posthumously published with Surrey's in Tottel's *Songes and Sonnettes*. Wyatt died at Sherborne, Dorset, Oct. 11, 1542. *See also* ENGLISH LITERATURE.

WYCHERLEY, WILLIAM (c. 1640-1716), English dramatist, was born in Clive, Shropshire, about 1640, and educated in France, where he became a Roman Catholic. Sent to Oxford, his faith was supposedly subverted by Bishop Barlow. He left without a degree, and later abandoned law to become a member of the dissolute circle around Charles II. He produced *Love in a Wood*, published probably in 1672. Opinions of Wycherley, later than those of Macaulay but agreeing with Dryden, are that *The*

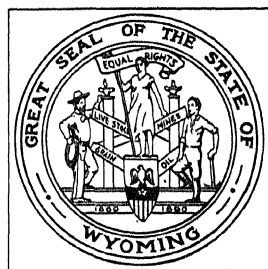
Country Wife, published 1675, and *The Plain Dealer*, 1677, are with his other plays satires of the corrupt Restoration scene. After 7 years in prison for debt, the dramatist was freed by James II, and in his old age was the admired of the wits, among whom were Pope, Addison and Steele. His comedies are well-constructed dramatically, extremely clever and, in key with the Restoration period, grossly immoral. Wycherley died a Roman Catholic, Jan. 1, 1716.

BIBLIOGRAPHY.—W. Connely, *Brawny Wycherley*, 1930.

WYCLIFFE, JOHN (c. 1324-84), English theologian and translator of the Bible, was born near Richmond, Yorkshire, about 1324. He was educated at Balliol College, Oxford, of which he became Master, probably resigning in 1361 to become vicar of Fillingham, Lincolnshire, and prebendary of Westbury, later being made canon of Lincoln. For the last ten years of his life he was rector of Lutterworth. His views on the corruption of the clergy brought him into conflict with the papacy, but his supporters were so influential that no sentence was passed on him until after his death. His translation of the Bible was not completed until 1400, most of the New Testament and part of the Old Testament being accomplished before his death at Lutterworth, Dec. 31, 1384.

WYLIE, ELINOR HOYT (1886-1928), American poet and novelist, was born in 1886 at Rosemont, Pa., and was educated in private schools and at Bryn Mawr. In 1923 she married William Rose Benét. Her first books were verse, *Nets to Catch the Wind*, 1921, and *Black Armour*, 1923. Afterward came several novels, *Jennifer Lorn*, 1923, *The Venetian Glass Nephew*, *Orphan Angel*, *Mr. Hodge and Mr. Hazard*, 1928, and in 1928 also a volume of poems, *Trivial Breath*. Both her verse and fiction reveal an unusual and vital personality. Elinor Wylie died in New York City, Dec. 16, 1928.

WYOMING, one of the Rocky Mountain States, sometimes called the "Equality State," lying between 41° and 45° N. lat. and 104° 3' and 111° 3' W. long.



WYOMING STATE SEAL

It is bounded on the north by Montana, on the east by South Dakota and Nebraska, on the south by Colorado and Utah, and on the west by Utah, Idaho and Montana. The total area of the state is 97,914 sq. mi., including 366 sq. mi. of water surface. From north to south, the breadth of Wyoming is 276 mi.; from east to west along the

southern border, its length is about 375 mi. In size Wyoming ranks eighth among the states of the Union.

Surface Features. Wyoming is a high plateau crossed from northwest to southeast by the Rocky Mountains. As a whole it has a mean elevation above sea level of 6,700 ft. and a relief varying from 3,100 ft. in Crook Co. to 13,785 ft. on the summit of Gannett Peak in Fremont Co. Except for the mountains,

the state belongs topographically to the semi-arid Great Plains.

The Wyoming Rockies consist of the Yellowstone Plateau in the northwest corner, set aside as Yellowstone Park, and a number of linear uplifts. The Absaroka range which occurs just east of Yellowstone Park is 100 mi. long, 50 mi. wide and varies from 10,000 to 12,000 ft. in height. Some distance east of it are the Big Horn Mountains, a massive uplift in the middle of which are the Cloud Peaks rising to over 13,000 ft. The Owl Creek and Bridger ranges connect its southern end with the Absaroka range, which almost encloses the Big Horn basin. South of the Absarokas are the Gros Ventre and Wind River mountains, the latter being one of the highest uplifts in the state with Gannett and Fremont peaks, both over 13,500 ft. The Teton range which lies just south of Yellowstone Park is a majestic mass with a deeply gashed granite crest culminating in Grand Teton, 13,800 ft. and Mt. Hayden, 13,700 ft. Just east of it is Jackson Hole and to the south are the Wyoming and Salt River ranges. The Laramie, Medicine Bow and Park ranges in southeastern Wyoming continue southward into Colorado. The Continental Divide follows the Wind River and Park ranges, between which there is no connecting crest but instead the Great Divide Basin, an area of interior drainage.

The continuity of the Rocky Mountains is interrupted by the Wyoming Basin, a westward extension of the Great Plains, which covers the entire southwestern part of the state. It is in reality an irregularly shaped plateau, 6,500 to 7,000 ft. high, almost enclosed by high mountains and studded by low isolated ranges. Several interior ridges divide it into subordinate basins. The Laramie and Shirley lie just west of the Laramie Mountains; the Shoshone and Wind River basins occur between the Wind River and Owl Creek ranges; and the Bridger basin is between the Green River and Oyster range. The drainage of the basin is remarkable in that its rivers flow in every direction and there is scarcely one but what crosses one or more mountain ranges. Within its borders rise the Green, a tributary of the Colorado which discharges into the Gulf of California; the Snake which is a tributary of the Columbia; and the Big Horn. The latter stream and the North Platte belong to the Missouri-Mississippi river system.

The area of Great Plains east of the mountains has little variation except for Goshen Hole on the Nebraska border where the North Platte valley has a lateral spread; and a section of the Black Hills protruding into the northeast corner from South Dakota.

Climate. Owing to its wide range in altitude, Wyoming exhibits great variations of climate. The mean annual temperature for the state, 41.5° F., is lower than that of any other mountain state, ranging from an average of about 36° F. in the mountains to 46° F. in the plains. At Lander, situated near the center of the state at an altitude of 5,372 ft., the average for January is 18.3° F. and for July, 67.4° F. During the period 1899-1930 the lowest temperature

recorded in Wyoming was -60° F. and the highest, 114° F. Similar variation occurs in the average annual precipitation which is 14.4 in. for the state, but which ranges from 6 in. in the lower Big Horn Basin to 35 in. in parts of Yellowstone Park. Wyoming is for the most part arid, but the southeastern section is relatively favorable for agriculture. At Cheyenne the average growing season is 122 days.

Forests and Parks. The forests are found chiefly on the mountain ranges of the northwestern and north central sections of the state. On the lower foothills and basal slopes are regions covered with high sagebrush, narrow-leaved cottonwood and western yellow pine. In the Montane Belt, a zone covering the middle mountain slopes and the highest foothill ranges are coniferous forests of Douglas fir, lodgepole pine, aspen, spruce and alpine fir. Above this belt is a comparatively narrow zone, subalpine, characterized by Engelmann spruce, alpine fir, and white-barked pine.

Ten national forests, Ashley, Bighorn, Black Hills, Caribou, Medicine Bow, Shoshone, Targhee, Teton, Washakie and Wyoming, located entirely or in part in Wyoming have a total net area of 8,476,276 acres within the state. They are extensively developed for camping and other recreational uses. Game is plentiful and includes elk, deer, bighorn sheep, Rocky Mountain goats, pronghorn antelope and moose as well as grouse, sage-chickens, ducks, geese, plover, snipe and coots. The Pole Mountain and Sheep Mountain districts of the Medicine Bow national forest have been set aside as national game refuges; state game refuges cover approximately 4,500,000 acres.

In Hot Springs State Park and Saratoga Hot Springs Park, both famous for the curative properties of their waters, and in Connor Battlefield State Park Wyoming has the beginning of a splendid park system. SHOSHONE CAVERN and DEVIL'S TOWER national monuments and GRAND TETON NATIONAL PARK are located in Wyoming; also the greater part of YELLOWSTONE NATIONAL PARK.

Minerals and Mining. Mining is a major industry. Although Wyoming possesses large ore deposits including iron, copper and gold, the most important resources commercially utilized are coal and petroleum. The oil fields, known to exist since 1832, were but slightly developed until after 1911. In addition to petroleum reserves there are immense deposits of oil shale. Coal ranks next to oil among the resources of the state. More than half of its area is underlain with beds of bituminous and subbituminous coal, which is mined in every county, but most extensively near Rock Springs and in the vicinity of Douglas.

With mineral productions in 1929 amounting to \$51,237,407, Wyoming stood twenty-second among the states, ranking second in sodium salts, fourth in phosphate rock and seventh in petroleum. It also stood seventh in quantity of iron ore produced.

The principal products in order of value were petroleum, 19,314,000 bbls., \$24,700,000; coal, 6,704,790 tons, \$17,052,000; natural gas, 44,648,000 M cu. ft.,

\$3,850,000; natural gasoline, 44,544,000 gals., \$3,241,000; and iron ore, 639,477 long tons, about \$1,500,000.

During 1929 73 mines and quarries gave employment to 5,552 persons who received \$10,294,402 in salaries and wages.

Soil. Although some of the more arid districts in Wyoming are too highly alkaline for cultivation, large areas of sandy soil overlying a clay subsoil require only irrigation in order to be made suitable for agriculture. There are alluvial deposits, brought down by mountain streams, which are exceptionally fertile. Lack of water rather than deficiency in the elements of soil fertility is the explanation why large areas devoted to grazing in the plains region have not been utilized for crop production.

Agriculture. Hay, grain, sugar beets and potatoes constitute the principal crops.

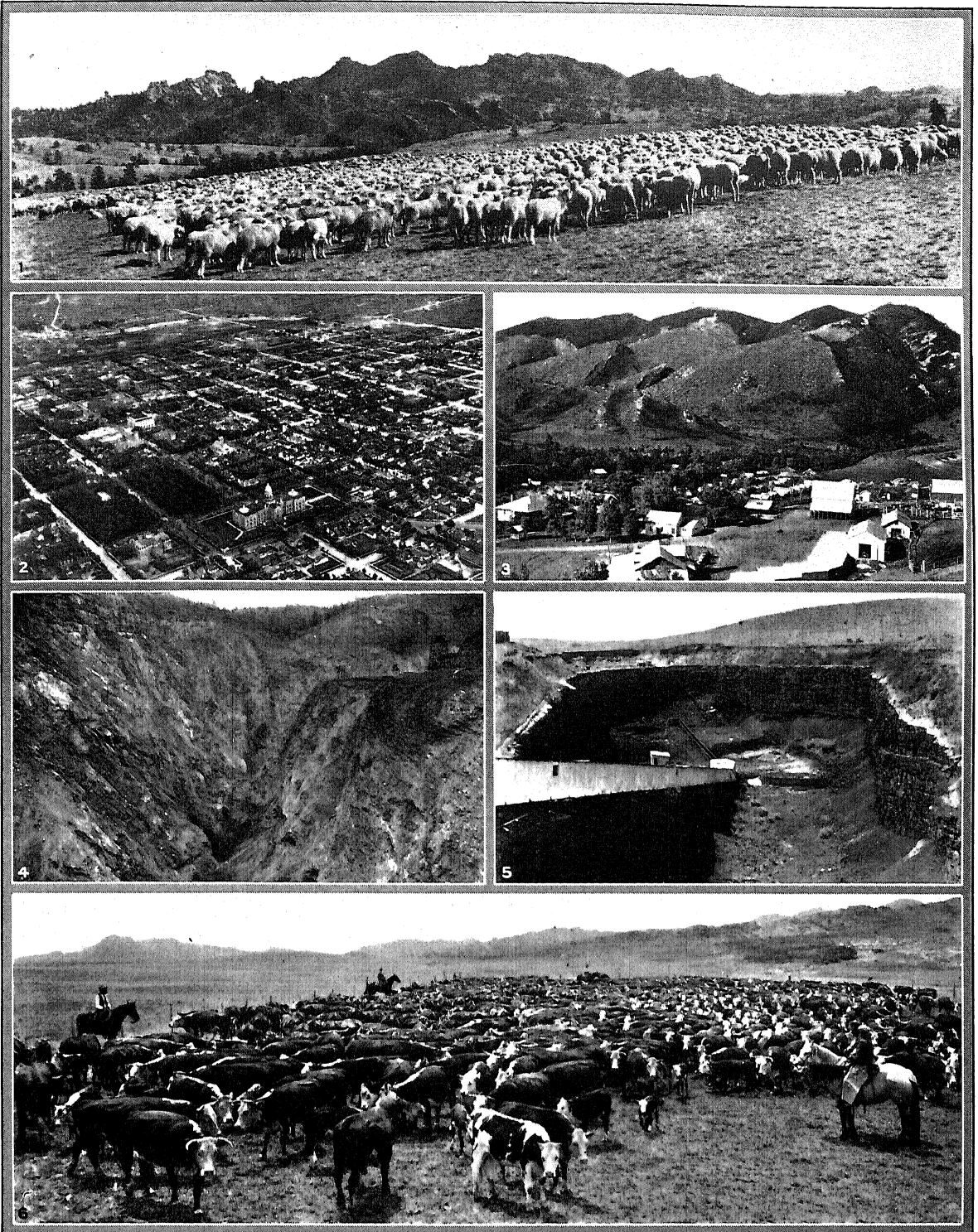
In 1930 23,525,234 ac. or 37.7% of the entire land area was in farms, 16,011 in number, with an average size per farm of 1,469.3 ac. and an average value per acre of \$8.79. Of the farm area 2,292,668 ac. was crop land, and 20,836,980 ac., pasture land. The total value of farm property was \$306,620,503, of which \$206,852,171 was represented by land and buildings; \$17,612,857, by implements and machinery; and \$82,150,475, by domestic animals.

According to the census of 1930 Wyoming produced in 1929 field crops to the value of \$29,371,461, ranking forty-second among the states. The chief crops were hay \$12,564,401, grain \$10,107,696, sugar beets \$3,531,496, and potatoes \$2,278,913. Of the total hay crop of 1,212,804 tons alfalfa furnished 615,664 tons. The grains included wheat, 4,298,085 bu., oats, 3,197,152 bu., barley, 2,738,673 bu., and corn, 1,062,206 bu. In sugar beet production Wyoming ranked fifth among the states with 492,229 tons. Farm products sold by cooperative marketing rose from \$646,748 in 1919 to \$2,465,886 in 1929. Farm machinery and equipment in 1930 included 12,824 automobiles, 4,108 motor trucks and 4,110 tractors.

Irrigation. For the production of field crops irrigation was established early in the settlement of the state. The period of greatest expansion in irrigated acreage was from 1880 to 1910. In the Census of 1930 irrigation operations were separately reported for each of the state's 23 counties. The chief developments are in the drainage basins of the Big Horn, North Platte, and Colorado rivers with their confluents. The tributaries of the Snake, Bear, Powder and Tongue rivers are also utilized. Irrigated farms comprised 45.6% of the number and 58% of the value of all farms in Wyoming. About 54% of the crop land is irrigated. The state stood sixth in total acreage irrigated and tenth in amount invested in irrigation enterprises.

The total number of irrigated farms was 7,308, with an aggregate area of 9,959,883 ac., of which 1,236,155 ac. were irrigated. Including land and buildings the value of all irrigated farms was \$120,208,187, or an average of \$12.07 per ac. The total investment in irrigation enterprises to 1930 was \$35,153,187, and

WYOMING



1, 3, 4, 5, 6, DEPT. OF COMMERCE AND INDUSTRY, CHEYENNE; 2, CHAMBER OF COMMERCE, CHEYENNE

AMONG WYOMING RANCHES AND MINES

1. Sheep flock on a Wyoming hillside. 2. Air view of part of residential district, Cheyenne. 3. A dude ranch, Mecca for eastern tenderfeet. 4. Open pit iron mine showing iron

deposit and pit, Sunrise, Wyo. 5. Wyo-Dak Coal Mine, the thickest coal vein in the United States, Gillette, Wyo. 6. Cattle ranching in Wyoming.

WYOMING

Area, 97,914 sq. m.
Pop. 225,565

PRINCIPAL CITIES

Pop.—Thousands

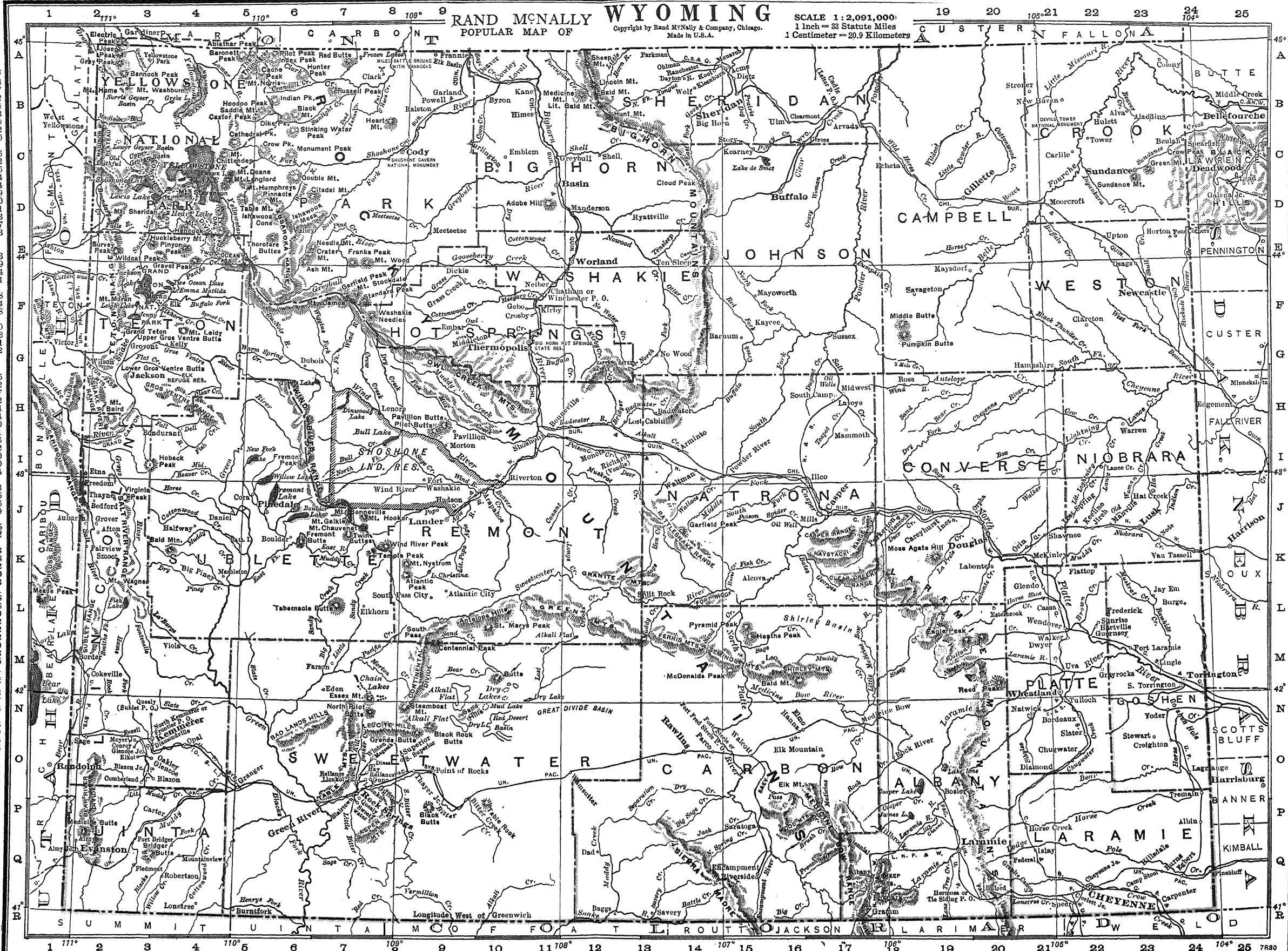
- 2 Buffalo... D 16
- 17 Casper... J 17
- 17 Cheyenne... R 22
- 2 Cody... C 8
- 1 Cumberland... O 3
- 2 Douglas... K 19
- 3 Evanston... Q 2
- 1 Gillette... D 20
- 3 Green River... P 6

Pop.—Hundreds

- 2 Greybull... C 12
- 2 Hanna... N 16
- 2 Kemmerer... N 4
- 1 Kleenburn... B 14
- 2 Lander... J 9
- 9 Laramie... Q 20
- 2 Lovell... A 11
- 1 Lusk... J 23
- 2 Midwest... H 17
- 1 Newcastle... F 23
- 2 North Kemmerer... N 3
- 1 Powell... B 9
- 5 Rawlins... N 14
- 2 Riverton... I 11
- 8 Rock Springs... P 8
- 9 Sheridan... B 14
- 1 Superior... O 8
- 2 Thermopolis... G 10
- 2 Torrington... N 23
- 2 Wheatland... N 21
- 1 Worland... E 12

Pop.—Hundreds

- 2 Acme... A 15
- 8 Arden... J 2
- 1 Arvada... B 17
- 9 Basin... D 12
- 2 Big Piney... K 4
- 3 Burns... Q 24
- 3 Byron... B 10
- 2 Chugwater... O 21
- 2 Clearmont... B 16
- 2 Cokeville... M 2
- 5 Cowley... A 10
- 3 Crosby... B 10
- 4 Dayton... B 14
- 2 Diamondville... O 3
- 3 Dietz... B 15
- 2 Dubois... A 9
- 2 Elk Basin... A 9
- 2 Encampment... Q 15
- 2 Fairview... K 2
- 3 Fort Laramie... M 23
- 2 Foxpark... H 18
- 5 Freedom... F 12
- 9 Gebo... F 10
- 2 Glencoe... O 3
- 2 Glendon... K 21
- 8 Glenrock... J 18
- 2 Gramm... R 18
- 5 Grass Creek... F 9
- 2 Grover... J 2
- 7 Guernsey... M 22
- 2 Hartsville... L 22
- 2 Hudson... J 9
- 2 Jackson... G 23
- 5 Kaycee... F 15
- 2 Kirby... F 11
- 4 Kool... A 14
- 8 Lavoie... H 17
- 2 Lingle... M 23
- 2 Mammoth... I 17
- 2 Manville... J 23
- 2 Medicine Bow... N 18
- 3 Meeteetse... E 9
- 4 Mills... J 16
- 5 Monarch... A 15
- 3 Moorcroft... D 21
- 2 Moran... F 3
- 6 Oakley... O 3
- 7 Parco... O 14
- 7 Pinebluffs... Q 25
- 2 Pinedale... J 6
- 5 Quealy (Sublet)... N 3
- 2 Ranchester... A 14
- 3 Rock River... O 18
- 2 Saratoga... P 15
- 2 Shoshoni... I 11
- 2 Smoot... K 2
- 2 South Pass... L 8
- 8 South Superior... O 9
- 5 Sublet (Quealy)... N 3
- 4 Sundance... O 22
- 2 Ten Sleep... E 14
- 4 Upton... E 22
- 2 Wilson... G 2
- 2 Wind River... J 8
- 3 Yoder... N 23

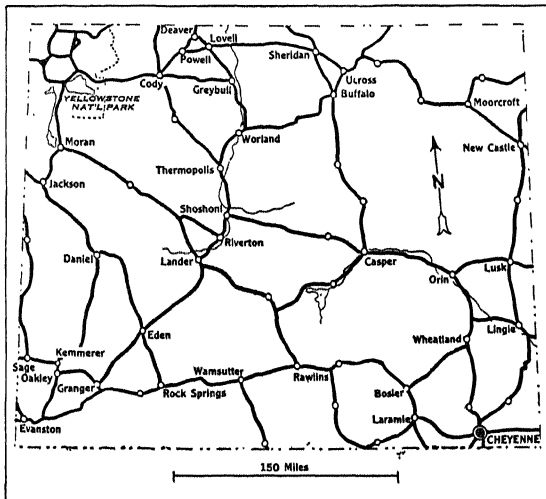


the average cost of maintenance and operation for 1929 was \$0.84 per ac.

Animal Industry. Cattle-raising and sheep-raising are the chief livestock interests. According to the census of 1930, Wyoming stood fourth among the states in number of sheep on farms and third in pounds of wool shorn. The state ranked twenty-fifth in total value, \$82,150,475, of domestic animals. Among these were 824,039 cattle reported from 13,137 farms or 81% of all farms in the state and valued at \$46,591,601; sheep, 3,425,635 in number valued at \$28,154,503; horses, 173,173, \$5,213,082; mules, 4,050, \$204,153, and swine, 97,993, \$1,291,224.

Of the cows on farms, 358,578 were kept mainly for beef production and 72,415 mainly for milk production. In 1929, 32,879,209 gals. of milk were produced; the total value of dairy products sold was \$4,268,042. The wool clip, 23,082,271 lbs., was valued at \$7,323,150. The poultry raised, with a value of \$1,625,025, included chiefly chickens, 1,258,343 in number valued at \$928,192, and turkeys, 233,016, \$672,636. Of 5,777,249 doz. chicken eggs produced, valued at \$1,639,152, 3,147,255 doz., with a value of \$894,301, were marketed. Honey, amounting to 1,600,565 lbs. valued at \$167,507, was produced from 18,689 hives.

Fisheries. There are no commercial fisheries in Wyoming, but the lakes and streams offer fine trout and other sportsmen's fishing. In 1930 the state issued 28,757 fishing licenses and received \$51,327 in fees. Eight fish hatcheries were operated at a cost of \$82,000 for the year, and the output was 8,500,000 trout. In addition, the U.S. Bureau of Fisheries planted 10,477,000 black spotted trout, 2,450,240 loch leven trout, 910,395 brook trout and 65,000 other fish.



WYOMING STATE ROADS

Transportation. The first locomotive entered Wyoming on the tracks of the Union Pacific railroad in 1869. This road is still the chief system, while the Burlington and the Chicago and Northwestern are also important. The mountainous character of the re-

gion has discouraged the construction of the branch lines necessary to provide adequate railway facilities. Transportation by water is negligible. In 1930 the total steam railway mileage was 2,044.

The highways, which have been considerably improved and extended since 1917, had a total mileage of 42,918 in 1930. This included 1,760 mi. of surfaced roads and 1,424 mi. of improved state highways. During 1929, highway expenditures amounting to \$1,063,098 were made by county and local governments. The state disbursed \$3,107,137 that year, while a like expenditure was made by the Federal Government. Gasoline consumption in 1930 aggregated 36,615,000 gals. The state gasoline tax in 1930 produced an income of \$1,447,005 as against \$568,589 in 1926. Motor vehicle registrations were 61,501 in 1930 compared with 47,711 in 1925. The rapid growth of transportation by truck is indicated by registrations, which rose from 5,164 in 1925 to 9,922 in 1930, or almost 100%. During the same period, the number of buses in operation increased from 547 to 847, or about 55%.

Manufactures. Except for petroleum refining, manufacturing industries are but slightly developed. According to the Census of 1930 Wyoming with manufactures for 1929 valued at \$96,348,076 stood forty-fifth among the states. Its 248 establishments gave employment to 896 officers and employees, who received \$2,288,632 in salaries, and to 6,258 wage earners, who were paid \$10,255,365 in wages. These factories used a total of 46,677 horse power, expended \$3,382,805 for fuel and power, and \$59,337,279 for material and supplies, and added by the process of manufacture \$33,627,992 to the value of their output.

In this output there were 16 separately enumerated industries. Outstanding among these was petroleum refining with an output valued at \$68,846,821 or 72% of the total manufactures of the state. Among minor products, with value of output were steam railway carshop construction and repairs, \$7,636,683; wood preserving, \$2,308,658; printing and publishing, \$1,557,352; lumber, \$1,391,259; butter, \$1,369,218; packed meats, \$1,277,166, and bread, \$1,198,983.

Commerce. According to the census of 1930, there were in 1929 283 wholesaling establishments in Wyoming, with total sales of \$34,660,887. These organizations gave full-time employment to 905 men and women, whose annual salaries and wages aggregated \$1,854,785.

The total sales of the 2,955 retail stores amounted to \$101,399,360. Sales per store averaged \$34,315; sales per capita were \$449.53.

CHIEF RETAIL DISTRIBUTING GROUPS

Group	No. of Stores	Sales	% of Total
Automotive	619	\$25,772,217	25.42
General Mdse.	373	22,581,590	22.28
Food	560	18,428,082	18.16
Lumber & Bldg.	188	8,364,383	8.24
Apparel	214	5,351,515	5.27
Furn. & Household ..	92	3,121,541	3.08
All other stores.....	909	17,780,002	17.55
Total, all stores ...	2,955	\$101,399,360	100.00

Finance and Banking. The value of all taxable property in 1929 was \$447,954,091, and the total bonded debt was \$1,900,000. State revenues amounted to \$9,693,985 in 1928; total disbursements were \$8,640,248. The chief sources of income were property taxes, corporation taxes, motor vehicle taxes and gasoline sales taxes of \$920,839. The principal payments were for highways, \$3,781,815 and education, \$2,063,427.

There were 83 banks in Wyoming in 1930. Of these, 25 were national banks and 58 trust companies and state banks. Their total capitalization was \$4,230,000; their surplus and undivided profits, \$4,426,000. Total resources were \$71,341,000, with loans and discounts aggregating \$39,196,000. Demand and time deposits totaled \$56,478,000. Per capita demand and time deposits were \$251.01; per capita savings deposits, \$101.29. The total savings of \$22,791,000 were owned by 54,796 depositors. National bank circulation aggregated \$1,482,000.

Government. The legislative body of Wyoming consists of a Senate composed of 25 members and a House of Representatives of 60 members, the former elected for terms of four years and the latter for terms of two years. They meet in biennial sessions limited in duration to 40 days. The chief executive is the governor elected for terms of four years at a salary of \$6,000 per year. Other executive officers are the secretary of state, auditor, treasurer, and superintendent of public instruction. Judicial power is vested in a supreme court, district courts, and justices of the peace. The supreme court consists of three judges elected for terms of eight years at salaries of \$7,000 per year.

Social Welfare Institutions. A State Board of Charities and Reform governs these institutions. There is an industrial school for delinquent boys at Worland, and for girls at Sheridan, and a training school for feeble-minded children at Lander. The deaf and blind are cared for in private institutions at state expense. At Cheyenne is a home for dependent children. A tuberculosis sanitarium is at Basin, a general hospital at Rock Springs and an insane hospital at Evanston. The state owns hot springs at Big Horn and Saratoga which are open to the public. A soldiers' and sailors' home is maintained at Buffalo. The penitentiary is at Rawlins.

Education. The first school law for the territory was enacted by the first legislature in 1869. By the next year there were 9 schools established, 4 of which were public. In 1928, there were 1,380 public schools, having 42,498 enrolled pupils, and 2,333 teachers. The 154 accredited high schools had 10,644 pupils and 598 teachers. Children from 7 to 14 years of age are required to attend school and the full term. The number of persons from 5 to 20 years of age attending school in 1930 was 51,671, or 73.7% of the population within the ages specified, as compared with 38,106, or 67.9%, in 1920. The number of persons, 10 years and over, unable to read and write in 1930 was 2,895, or 1.6%, as compared with 3,149, or 2.1%, in 1920. For higher education the state maintains the University of Wyoming at Laramie.

Population. In 1930 Wyoming ranked forty-seventh among the states with a population of 225,565 or an average of 2.3 per sq. mi., an increase of 31,163 or 16% over 1920. The population rose from 9,118 in 1870 to 92,531 in 1900, 145,965 in 1910, and 194,402 in 1920. In 1930 there were 214,067 or 94.9% whites, 7,174 or 3.2% Mexicans, 1,845 or 0.8% Indians, and 1,250 or 0.6% Negroes. Of the whites, 194,409 were native-born and 19,658 were foreign-born. The rural population was 155,468 or 68.9% of the total, an increase of 18,414 or 13.4% from 1920; the urban population was 70,997 or 31.1% of the total, an increase of 12,749 or 22.2% since 1920. In 1930 the two largest cities were Cheyenne, 17,361, and Casper, 16,619.

Occupations. In 1930 92,448 persons, or 41.0% of the population, were gainful workers 10 years old or older; 86.2% of these were males and 13.8% were females; 81.1% were native white; 13.3% foreign-born white; 0.8% Negro, and 4.8% other races. Among the chief occupations, with number of workers, were agriculture, 30,795; manufacturing, 15,155; transportation and communication, 9,788; trade, 7,726; domestic and personal service, 7,371; professional service, 6,448, and mining, 6,313.

HISTORY

Inhabited by Ute, Cheyenne, Arapaho, Crow, and Sioux Indians, Wyoming possibly attracted Spanish traders who have left no record. The French explorer Verendrye in 1743 evidently penetrated the eastern portion of the state. John Colter, member of the Lewis and Clark expedition, after trapping elsewhere in the state, discovered the Yellowstone region in 1807. Thereafter Wyoming was frequently visited by traders and was explored by several notable parties: the overland expedition to Astoria led by Wilson Price Hunt, which crossed the continental divide at Sherman Pass, 1811; the return party under Ramsey Crooks and Robert Stuart, which discovered the South Pass and was first to explore the Sweetwater and Platte river valleys; the traders led by Thomas Fitzpatrick, 1824, who inaugurated regular traffic with the western Indians. In 1834 Ft. Laramie, the first white settlement in Wyoming, was built by traders at the confluence of the Laramie and North Platte rivers, and was for 15 years the center of the fur trade in eastern Wyoming. The streams of emigration along the OREGON TRAIL traversed the territory, passing Ft. Laramie, Ft. Bridger, built in 1843 on Black's Fork in the extreme southwestern corner of the state, and a chain of posts built by the government to protect the increasing volume of emigration from Indian depredations. The trails of the Mormons and the California gold-seekers, of the overland stage, the Pony Express, the "Pacific telegraph," and then of the Union Pacific Railway crossed the region. The discovery of gold led to the founding of South Pass City in 1867; in 1868 advance agents of the Union Pacific founded Cheyenne.

On July 25, 1868, Congress created the Territory

of Wyoming, and on July 10, 1890, admitted Wyoming, with a total population of 92,531, as the 44th state, the first to grant in its constitution suffrage regardless of sex.

Since 1900 Wyoming has more frequently voted the Republican than the Democratic ticket. In the 1932 election, however, the state gave its three electoral votes to Franklin D. Roosevelt. Harry W. Weston, Republican, was elected governor.

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WYOMING, a borough in Luzerne Co., northeastern Pennsylvania. It is situated on the Susquehanna River, 5 mi. north of Wilkes-Barre and is served by river craft and two railroads and has an airport. The borough lies in an important anthracite coal field; the chief industry is mining. Pop. 1920, 3,582; 1930, 4,648.

WYOMING, UNIVERSITY OF, at Laramie, Wyo., a coeducational state institution, organized in 1886. In 1890 the State Agricultural College became a part of the university organization. It comprises the Preparatory School, College of Liberal Arts, Graduate School, Normal School, College of Agriculture and Agriculture Experiment Station, College of Engineering, School of Mines, School of Commerce, School of Music, Department of Secondary Education and a Summer School. The university had an endowment fund in 1931 amounting to \$2,408,708.

The library contained 84,925 volumes. In 1931-32 there was a student enrollment of 1,235, and a faculty of 203 headed by Pres. A. G. Crane.

WYOMING MASSACRE, 1778, a frontier tragedy of the REVOLUTIONARY WAR. The raiding party of 1,100 Tories and Indians, commanded by John Butler, Sir John Johnston and the half-breed JOSEPH BRANT, swept down upon the isolated settlements of the Wyoming valley, northern Pennsylvania. The settlers, forewarned, gathered in Forty Fort (near the present Wilkes-Barre). Enraged by the desolation of their farms and buildings, the fighting strength of the valley, 400 men and boys, attacked the invaders on July 3, 1778, but were defeated with a loss of between 250 and 300 killed or captured. The remainder, taking refuge in the fort, surrendered the following day.

WYSS, JOHANN RUDOLF (1781-1830), Swiss author, was born at Bern, Mar. 13, 1781. He was educated at the University of Bern and in 1806 became Professor of Philosophy in that institution. He is noted as the author of the Swiss national hymn, but is perhaps better known for his *Swiss Family Robinson*, 1812-13, a popular child's story and the only successful imitation of ROBINSON CRUSOE. Wyss wrote much on Swiss folklore, his most important work in this field being *Idyllen, Volksagen, Legenden, und Erzählungen aus der Schweiz*, 1815-22; he also edited the collection of tales entitled *Alpenrose*, 1811-30. He died in Bern, Mar. 31, 1830.

X

XANTHIPPE or **XANTIPPE**, the wife of **SOCRATES**, the famous Greek philosopher. She is generally believed to have been shrewish and quarrelsome.

XAVIER, ST. FRANCIS (1506-52) famous Spanish Jesuit missionary, called "the apostle of the Indies," was born at the castle of Xavierno, Navarre, Apr. 7, 1506. At the University of Paris, where he was educated, he met Ignatius Loyola, the founder of the Society of Jesus, who quickly won the attachment of Francis. The latter became one of the first members of the new society. He left Paris in 1536 for Italy, where, particularly in Venice, he labored among the sick in the hospitals. He was ordained in 1537. Three years later he was active at Lisbon, from which port in 1541 he began his famous missionary voyages, arriving at Goa in India in 1542. His missionary journeys took him to western and southern India, to Malacca and to Japan, in which country he spent two and a half years, learning the language and translating the chief articles of his faith into Japanese. He died on the island of Sancian, off the coast of China, Dec. 2, 1552, while on his way to start a mission in that country, and was buried at Goa, India. He was canonized in 1622 and many Catholics account him the greatest missionary since the days of the Apostles.

XAVIER COLLEGE, a Catholic coeducational institution in Cincinnati, O. It originated in the Athenaeum, opened in 1829 and dedicated to St. Francis Xavier; later it was transferred to the Jesuits, and named St. Xavier College. Its present title, Xavier College, was adopted in 1930. The courses are in arts and sciences, commerce and law. In addition preparatory and summer schools and a teachers' college are maintained. The productive funds in 1931 were \$228,000. The library contained 70,000 volumes. In 1931-32 there were 1,985 students and a faculty of 84, headed by the Rev. Hubert Brockman.

XENIA, a city in southwestern Ohio, the county seat of Greene Co., situated 5 mi. from the Little Miami River, and 16 mi. southeast of Dayton. Xenia is served by two railroads and bus lines. Live stock and farm products are raised in this region. The city has many manufactures, including furniture, rope, twine and shoes. The retail trade in 1929 amounted to \$6,927,991. Near by is Wilberforce University for Negroes. Xenia was planned in 1808. John Bryan State Park, 500 acres in area, a part of which is being developed as a forest arboretum, is a few miles north. Pop. 1920, 9,110; 1930, 10,507.

XENON, a chemical element belonging to the group of the RARE GASES,—symbol Xe, atomic weight 130.2. It was discovered by Ramsay and Travers in 1898, and occurs in the atmosphere to the extent of

about one part in 17,000,000. It is a colorless, odorless gas which liquefies at -109° C. and solidifies at -140° C.

XENOPHANES (556-c. 456 B.C.), Greek philosopher and commonly identified as the founder of the Eleatic school, was born at Colophon in 556 B.C. His early life was spent in wanderings. He went to Sicily where he recited his own verses at the court of Hiero the Tyrant. Later he crossed to Magna Graecia, and for 70 years was a teacher of philosophy. A Pythagorean, he repudiated some of the doctrines. As his works have come down to posterity in a fragmentary condition, it has never been ascertained whether or not Xenophanes was monotheist or pantheist. He died about 456 B.C.

XENOPHON (c. 445-355 B.C.), Athenian historian and soldier. A pupil of **SOCRATES**, he has given a picture of his master's character and beliefs in the *Memorabilia of Socrates*. In 401 B.C. he accompanied Cyrus the Younger on his march to wrest the throne of Persia from his brother Artaxerxes. Cyrus was killed at Cunaxa, whereupon Xenophon, putting himself at the head of the Greek mercenaries in Cyrus' army, numbering about 10,000, led them with daring and skill safely back from the Tigris to the Black Sea. His most celebrated work the *Anabasis* records this exploit. Among his other writings are the *Hellenica*, a history of Greece from 411-362 B.C., the *Cyropaedeia*, an idealized portrait of Cyrus the Great, a *Life of Agesilaus* and several shorter essays. His literary style is simple and attractive.

XEROPHTHALMIA, an infection of the cornea of the eye induced by a lowering of the resistance of the body following a lack of vitamin A in the diet. (See **VITAMINS**.) Vitamin A is the growth-promoting, fat-soluble vitamin which is found in such substances as animal fat, butter, and **COD LIVER OIL**. Restoration of the vitamin to the diet will cure the disease if it is not too far advanced.

XEROPHYTE, a plant adapted by its structure or behavior to successful life in a habitat where the normal supply of water is low or the available water absorbed with difficulty. Such plants are primarily characteristic of deserts with low rainfall, rocks and sands where water is not held freely in the soil, bogs and salt marshes where solutes in the water interfere with absorption, and alpine and arctic regions. Typical xerophytic structures include highly developed root systems, water-storage tissues, thick, stiff, or leathery leaves, reduced leaf-surface, and stomata protected against excessive transpiration. The cell-sap of xerophytes usually has a high osmotic pressure. See also **MESOPHYTE**.
H. A. G.

XERXES (485-465 B.C.), King of ancient Persia. Determined to avenge the defeat suffered at Marathon,

490 B.C., by Datis and Artaphernes, the generals of Darius, his predecessor, Xerxes prepared a mighty armament to invade Greece. His huge army proceeding overland, by keeping near the coast, received the support of his navy. The Persian army with difficulty forced the pass of THERMOPYLAE, which was bravely defended by LEONIDAS, and at the same time the Persian fleet drove back the Athenians at Artemisium, 480 B.C. A few weeks later after his army had occupied Athens the overwhelming defeat of his navy at Salamis, 480 B.C., caused Xerxes to return precipitately to Asia Minor leaving operations in Greece in the hands of Mardonius. After the latter's defeat at Plataea, 479 B.C., Xerxes abandoned all thought of conquering Greece and contented himself with disputing Greek supremacy in the Aegean. A cowardly and dissolute monarch, he was assassinated by Artabanus, a captain in his own royal guard.

X-RAYS, electromagnetic radiation sent out into the surrounding space when moving ELECTRONS are stopped by collision with a material body. Increasing the number of electrons, other things being unchanged, increases the intensity of the radiation but does not alter its quality, for the emission of radiant energy occurs separately for each electronic collision. There is a well established law that the FREQUENCY of the radiation emitted at one such collision is proportional to the amount of energy converted by that collision into the radiant form (*see* QUANTUM THEORY). Consequently, the maximum frequency of the radiation obtained from any beam of electron is limited by the energy of motion of the swiftest electron in the beam. Since, generally speaking, the penetrating power of the radiation increases with its frequency, it follows that the swifter the beam of electrons the more penetrating will be the radiation obtained.

X-rays are produced by accelerating electrons in a vacuum by means of applied high voltage and having them strike a metal target, from which the rays are then emitted. In the Coolidge tube, the source of the electrons is tungsten wire maintained at white heat by an electric current (*see* ELECTRONICS). These electrons are accelerated in a very high vacuum to speeds of the order of 100,000 mi. per sec. They strike a target made of a metal, the high melting point of which will withstand the heat generated by the impact. The Crookes' Tube, an early form of x-ray tube, contained gas at low pressure.

The penetration of x-rays makes them very useful in medicine and in industry. Ordinary tissue is transparent to them. The bones are rather opaque and the heart, liver and other organs are partly so. The digestive tract and the blood vessels may be made relatively opaque by the introduction of harmless heavy substances. Under x-radiation, these parts of the body will cast shadows which are registered on a photographic plate. Certain substances become luminous under the action of x-rays. If such a substance is spread on a screen, the x-ray shadows are made visible to the eye. These uses of x-rays make them indispensable in medical diagnosis. Absorbed in sufficient

quantity of tissue, x-rays are very destructive and workers with them must take thorough precautions. As this effect is more pronounced on unhealthy tissue than on sound, it makes x-rays valuable in treating skin diseases and inoperable cancers. In industry, x-rays are of value especially in the internal examination of materials to detect hidden flaws.

X-rays and visible LIGHT are both components of the ELECTROMAGNETIC SPECTRUM, differing only in the fact that the frequencies of x-rays are thousands of times greater than those of visible light. X-ray frequencies are of the same order as those of the less penetrating of the GAMMA-RAYS emitted by radioactive substances. This difference in frequency, with the corresponding converse difference in wave-length, accounts for the differences between the two kinds of radiation. X-rays are not directly perceived by the eye and are more penetrating than visible light. They are refracted (*see* REFRACTION), however, to a vastly less extent than visible light. They are not reflected by a polished surface because no surface can be so polished as not to have irregularities greater than the wave length of the rays. Consequently, unlike visible light, they cannot be polarized by reflection, but they can be polarized by scattering, as is visible light (*see* POLARIZATION OF LIGHT).

The formation of COLORS by thin films in soap-bubbles is a familiar example of the optical phenomenon known as INTERFERENCE OF LIGHT. By a relation between the thickness of the film and the wave-length of the light, either can be determined if the other is known. An analogous phenomenon occurs when a beam of x-rays strikes a crystal. The atoms in the crystal are arranged in planes, parallel and evenly spaced, and the separation of these planes bears about the same ratio to the wave-length of x-rays as the thickness of a soap-bubble film bears to the wave length of visible light. Through this phenomenon, the wave lengths of x-rays are determined by using crystals of known structure, and, conversely, the structure of crystals is discovered by using x-rays of known wave-length. *See also* X-RAY SPECTROSCOPY. R. T. C.

X-RAYS IN MEDICINE. *See* ROENTGENOLOGY and ROENTGENOTHERAPY.

X-RAY SPECTROSCOPY. X-RAYS, like visible LIGHT, possess all the properties of waves and may therefore be arranged in order of WAVE-LENGTH. When so arranged they constitute x-ray spectra which is subject to much the same classification as light spectra, viz., EMISSION SPECTRA and ABSORPTION SPECTRA, continuous spectra or "general radiation," and LINE SPECTRA or "characteristic radiation."

The principal difference between x-rays and other types of radiation is one of wave-length. X-rays possess a wave-length roughly from one one-hundredth to one one-thousandth of that of visible light. Moreover, the technique of the production of x-ray spectra is quite different than that used in the SPECTROSCOPY of other wave-lengths. PRISMS are utterly useless in the production of x-ray spectra and DIFFRACTION GRATINGS have only recently become useful in this

field. Also, the wide variation in penetrating power of different wave-lengths of x-rays introduces corresponding variations into experimental methods. Short wave-lengths, i.e., the "hard" x-rays used in medical practice, are very penetrating, and in using them elaborate precautions are necessary to prevent injury to the operators and patients. On the other hand, the longer "soft" x-rays are unable to penetrate even ordinary air. Apparatus used in experimentation with this type must be entirely enclosed in an evacuated chamber. While these long x-rays have no present therapeutic application, the study of them has yielded much valuable scientific data. The diffraction grating has been found primarily of service in connection with long x-rays.

Before the ruled grating came into use in x-ray spectroscopy, x-ray spectra were produced by using crystals, e.g., rock salt, in place of gratings. This was made possible by the regularity of the arrangement of atoms in crystals, as compared with the random arrangement of atoms in non-crystalline materials. The regular rows of atoms in crystals perform a function similar to the rulings on gratings, except that the atomic rows are more closely spaced than the rulings on any grating could possibly be. Also, crystals are three-dimensional instead of one-dimensional as are ordinary gratings. The theory and practice of their use is correspondingly more complicated.

The accuracy of wave-length measurements with a grating is limited principally by the accuracy of knowledge about the distance between the rulings of the grating used. This is known to a high degree of precision in the case of ruled gratings. When crystals are used, however, the measurement of distance between adjacent rows of atoms becomes a major problem. This is greatly simplified in the case of crystals whose atoms have a simple cubical arrangement, as is the case for rock salt. It has been found possible to compute it for this crystal from knowledge of the density of rock salt and the weight in grams of the atom of sodium and chlorine. The "grating space" being thus determined, the wave-lengths of x-rays upon which the crystal grating acts may be determined much as the wave-lengths of ordinary light are determined with the aid of a ruled grating.

The equation which is commonly used to give the relation between x-ray wave-length and the "grating space" of a crystal was first developed by Sir W. L. Bragg in 1912, and, hence, is called Bragg's Law. It is

$$l = \frac{2d \sin \theta}{n}$$

where l is the wave-length of x-rays under observation, d is the "grating space" of the crystal, n has one of the integral values 1, 2, 3, etc. depending on the so-called "order" of the spectrum, and θ is the angle at which the diffraction effect becomes clearest.

Bragg's Law may be used in either of two ways: first, to use a known spacing of the atoms of a crystal to give information about the wave-length of x-rays; and, second, to use known wave-lengths of x-rays to give information about the spacing of atoms. As in-

dicated above, it was originally used in the first way in connection with crystal gratings of rock salt. Certain x-ray wave-lengths having been established in this way, the second use of Bragg's Law made it possible to measure distances between adjacent rows of atoms in the more complicated kinds of crystals. Almost all of the knowledge of crystal properties has come in this way. Bragg's Law may properly be said to have laid the foundations both of x-ray examination of crystal structure and of x-ray spectroscopy.

One of the earliest and most important applications of Bragg's Law was made by H. G. J. Moseley in 1913. He discovered that a simple relation exists between x-ray wave-lengths of various chemical elements and the positions of those elements in the periodic table. This relation, known as MOSELEY'S LAW, placed the concept of the "atomic number" on a firm foundation. With its aid, the existence of several new chemical elements were predicted and their nature described, and the anomalous arrangement of certain pairs of elements in the periodic table, e.g., cobalt and nickel, tellurium and iodine, was adequately accounted for.

One of the discoveries made possible by the development of precision measurement of x-ray wave-lengths was that of the change of wave-length when x-rays are scattered. X-rays are scattered by solids in much the way that visible light is scattered by fog or smoke. For visible light, however, the scattered light does not suffer the change in wave-length which has been observed in the case of scattered x-rays. The most satisfactory theory of this change of wave length, involving QUANTUM THEORY concepts, was proposed by A. H. Compton. The wave-length-change is consequently known as the COMPTON EFFECT.

X-ray spectroscopy has been applied effectively in other fields than those mentioned above. So fertile has it been, in fact, that no exaggeration is involved in the assertion that x-ray spectroscopy has yielded more information on the structure of matter and the nature of radiation than any other type of experimental approach.

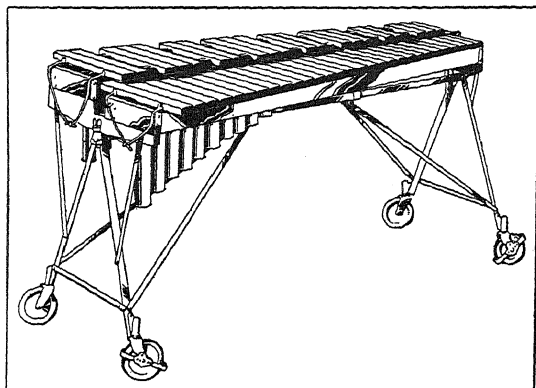
L. W. T.

XYLOL, or **XYLENE**, a name applied to three aromatic hydrocarbons, the dimethylbenzenes, $C_6H_4(CH_3)_2$, occurring in isomeric forms. The xylols, like BENZENE are found in tar distillate. They are designated by the prefixes "ortho," "meta" and "para."

XYLOPHONE, a musical instrument composed of graduated wooden bars struck with mallets. It resembles the African *marimba* in principle and is used occasionally in the orchestra. The tone is high and fairly liquid although penetrating. Its name, derived from the Greek, means "sounding wood."

XYLOSE, a dextro-rotary five-carbon sugar obtained by the extraction and hydrolysis of xylan from cottonseed hull bran. The bran is prepared by cutting from the hulls the last remaining fuzz of cotton after the linters have been removed. For the manufacture of xylose it is first pretreated with a hot and then a cold water wash, followed by a treatment with cold dilute sulphuric acid, which removes gums and ash. The xylan is then extracted and hydrolyzed by hot

dilute sulphuric acid under steam pressure, following which the acid is neutralized by the addition of lime and the xylose solution filtered, evaporated and crystallized.



COURTESY C. G. CONN

XYLOPHONE WITH ELEVATED MOUNTING OF SHARPS AND FLATS

Xylose is said to have no food value and so may find use as a sugar for diabetics. Commercial production of the product is being held in abeyance pending the discovery of a practical use for it. C. H. P.

BIBLIOGRAPHY.—W. T. Schreiber, N. V. Geib, B. Wingfield and S. S. Acree, "Semi-Commercial Production of Xylose," *Industrial and Engineering Chemistry*, 1930.

X Y Z MISSION, an American mission sent in May, 1797, to France in an attempt to adjust the strained relations between France and the United States. President John Adams appointed John Marshall and Elbridge Gerry to act with C. C. Pinckney, American minister to Paris. The commission was united in Paris in Oct., and attempted to open negotiations; Talleyrand, French minister of Foreign Affairs, refused them official recognition, but sent agents. These agents, Hottinguer (X), Bellamy (Y), and Hauteval (Z) demanded a loan to the French Republic and large bribes to its directors as the preliminary to negotiations. The commissioners were given to understand that if these loans and bribes were not made war might result. These overtures were rejected and communicated to President Adams. At the request of Congress the communications were transmitted to that body; but the names of the French agents were suppressed, X, Y and Z being substituted. The publication of the papers produced intense excitement in Congress and the nation. The popular indignation was summed up in the phrase, "Millions for defense, but not one cent for tribute," and the Government took steps to prepare for a possible war with France. Though war was not actually declared, French and American privateers despoiled each other on high seas, while the American navy captured a number of French ships suspected of preying on our commerce.

Y

YABLONOI or **Yablonovoi**, a ridge of mountains in northeast Asia, between the Amur and Lena basins in southern Siberia. The mountains extend for almost 1,000 mi. to near the Mongolian frontier, and culminate with the massive Sokhondo (8,370 ft.). The slopes are forested with larch and birch.

YACHT, a sail or power driven pleasure or racing craft. Perhaps the most famous yachts are those that have raced for the American cup, as the *Enterprise*, *Shamrock* and *Reliance*, of recent years. Steam yachts, where the motive power was at one time a steam engine or a turbine, are gradually being superseded by Diesel engines. The following craft are often popularly called yachts.

Ketch, a small sailing vessel with two masts, the foremost being the highest, carrying a jib and main sail, while the after mast which is forward of the rudder only has a small sail. This rig is common in England, but is seldom seen in the United States.

Knockabout, a small one or two mast sailing craft, without a bowsprit, and having a long overhang forward and aft. It may be either Marconi or fore and aft rigged, generally the former, with a single mast.

Schooner, a vessel when built for pleasure purposes, has two or three masts with fore and aft sails. Schooners are sometimes rigged with Marconi foresail and mainsail.

Sloop, a single mast vessel, having fore and aft sails. It may be Marconi rigged, comprising a jib and a main sail having no gaff, that is triangular in shape, with the apex at the mast head. The Marconi rig is sometimes called Bermudian or leg-of-mutton.

Yawl, a small sailing vessel with two masts, the foremost being the highest carrying a jib and a main sail, while the after or jigger mast which is aft of the rudder only has a small sail. Yawls are usually heavily built and particularly suitable for cruising. *See also* BOAT.

C. H. Hu.

BIBLIOGRAPHY.—W. D. Bowman, *Yachting and Yachtsman*; E. Sullivan, *Yachting*; H. Patterson, *Yacht Sails and How to Handle Them*.

YACHTING, the sport or pastime of sailing or racing a yacht. Modern yacht racing began with the formation in England of the Royal Yacht Club at Cowes in 1812. In the United States organized yachting dates from 1840, when races open to all classes of sailboats were held in New York harbor. Four years later the New York Yacht Club was organized, and under its sponsorship yachting grew apace on the eastern seaboard. International yachting may be said to have begun with the trophy contest in 1851 between the *America*, a schooner of 208 tons designed by George Speers, and 14 British boats, around the Isle of Wight. The American victors set aside the trophy

in 1857 as a permanent international award, to be known as the AMERICA'S CUP. Between 1870 and 1930 the British made 14 unsuccessful attempts to take the trophy from the custody of the New York Yacht Club.

The extent of yachting in the United States is reflected in the yacht tonnage, which since 1920 has been the largest of any nation, and the number of yacht clubs, also the largest of any country. The popularity of racing in yachts of large tonnage has been due in part to the genius of Edward Burgess (1848-91) of Boston, who designed three defenders of the America's Cup. His ideas have been improved and elaborated by W. Starling Burgess and N. G. Herreshoff.

In 1898 American enthusiasts began to demand competitions for smaller craft, and this led to races in which yachts of one design vie for supremacy. The chief racing classes in this one-design field are the 30-, 40- and 50-foot boats of the New York Yacht Club, the Bar Harbor 31-footers, Larchmont O class, Seawanhaka 38-foot schooners, sailed in the Seawanhaka Cup races between the United States and Canada, Class S, Star class, 12-meter class, 8-meter class, and many models under 20 feet. Races in these divisions are held annually throughout American waters, the chief regattas being the New York to Bermuda contests for the Royal Bermuda Yacht Club Trophy, the Astor Cup for sloops, the Cape May and Brenton Reef cup races, the King's Cup, Vanderbilt Cup, and the Six-Meter Race. Yacht races of this importance are held under the rules of the North American Yacht Racing Union, which is affiliated with the International Yacht Racing Union.

Yacht races have been intermittently held between the American coast and Ireland and Spain. In 1905 the American 3-masted schooner *Atlantic* established a record of 12 days, 4 hours and 1 minute for the course of 3,013 miles between New York and the Irish coast. Every two years yachts compete between the coast of California and Honolulu.

YAHGAN or **YAGAN**, a South American tribe and linguistic stock inhabiting the southern coast of Tierra del Fuego. They are a hardy people who lead a rigorous life, spending most of their time on the water in boats made of bark. Their food consists chiefly of shellfish and crabs; they also kill guanacos, otters and occasionally whales. Clothing is scant, despite the raw climate. The women wear a triangular apron and the men only a piece of hide over the shoulder.

YAK (*Poëphagus grunniens*), an ox of Tibet and the high Himalayas. Wild herds still wander, pasturing on the wirelike grass, yet sportsmen find it very hard to obtain a trophy head. The yak has a

massive body with short legs and sure feet. The body is clothed in short, blackish hair, but from the chin, throat and lower part of the sides it grows very long, forming a sort of valance which serves as a protective mat under the animal when it lies down on ice or cold ground. Both sexes have strong spreading horns used as defenses against wolves.

Tame yaks have long been used as beasts of burden throughout central Asia, and as riding animals, but Europeans find their rocking pace very trying. The flesh is excellent, and the milk and butter made from it is very good. From the hides clothing, tent-covers and harness are made, and the long hair is twisted into remarkably strong ropes. E. I.

YAKIMA, an important tribe of the North American Indian Shahaptian linguistic stock, formerly occupying both banks of the Columbia River and the northern tributaries of the Yakima and Wenatchee rivers in Washington. Culturally they are not well known, but presumably they did not differ markedly from other Shahaptian tribes. They now live on the Yakima Reservation in Washington, raising stock and farming. In 1931 the population was about 3,000, consisting of the survivors of about 13 tribes of the Shahaptian, Salishan and Chinookan stocks which were established on the reservation as one group, following a treaty with the United States in 1855.

YAKIMA, a city in south central Washington, the county seat of Yakima Co., situated on the Yakima River, 1,065 ft. above sea level, about 100 air miles southeast of Seattle. Bus and truck lines and two railroads afford transportation. The city is on the new Naches Pass Highway. This region, once a sagebrush wilderness under irrigation, has become unusually fertile. Fruit is the chief crop; diversified farming, poultry raising and dairying are fast-growing interests. Timber cutting is also an important industry. Yakima is the trade center for the district, and has packing and enormous cold storage plants, canneries and lumber mills. The manufactured output, 1929, was worth about \$6,000,000; the retail trade amounted to \$23,588,308. The city was founded in 1847 and incorporated in 1886. It is the seat of Yakima Valley Junior College. Yakima is a southeastern gateway to Rainier National Park, and is a few miles north of Yakima Indian Reservation. Pop. 1920, 18,539; 1930, 22,101.

YAKONA, a North American Indian linguistic stock, the tribes representing the southern limits of the culture of the coastal Salish peoples of Washington, the adjacent Athapaskan tribes conforming more with the generalized California type of culture. Never numerous, the Yakona occupied coastal Oregon from the Yaquina southward to the Umpqua River. Four tribes were included in this family, the Alsea, Yaquina, Siuslaw and Kuitsh, none of which is well-known culturally and all of which are now extinct as pure bloods, although some mixed-bloods are probably on the Siletz Reservation in Oregon. They resembled in many respects the tribes to the north, practicing artificial head-deformation, maintaining a system of

social ranking with a tendency to marriage outside the tribe, and had a mythology and traditions resembling those of the coast tribes of Washington. The Californian peoples exerted some influence on the Yakona.

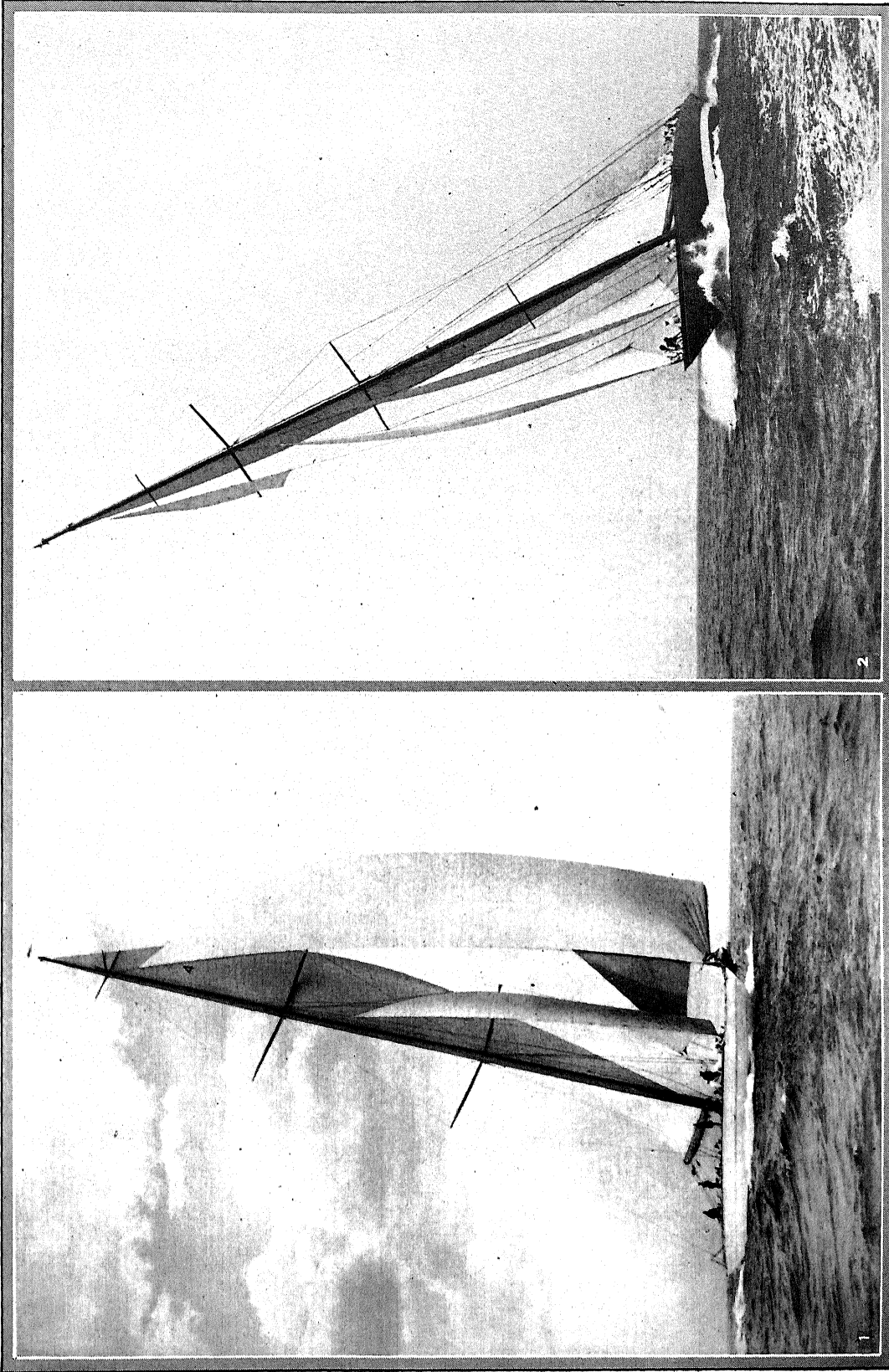
YAKUTAT, one of the tribes of the Tlingit, belonging to the North American Indian Kuluschan linguistic stock. Their principal habitat was around Yakutat Bay but their territory extended also to Copper River on the north and to Dry Bay, Alaska, on the south.

YALE, ELIHU (1649-1721), English colonial official, was born at or near Boston, Mass., Apr. 5, 1649. When he was three years old his family sailed for England, and he never returned to America. Little is known about his early life in England or his schooling. He went to India when he was 23 years old in the service of the British East India Co. and was made a minor official of the Colony at Ft. Saint George, Madras, in 1677. During the absence of Gov. Gyfford in 1684 he acted as governor and was made governor in 1687, continuing in this office until 1692. He remained in Madras until 1699 when he returned to England and then became governor of the East India Co. Yale had made a valuable collection of East Indian curiosities and in 1718, at the request of Cotton Mather, shipped a cargo of these and books to the trustees of the Collegiate School of Connecticut. This collection was sold and the proceeds, about £800, used for the school. In recognition of his gift the name of the institution was changed to Yale College, later called Yale University. Yale died at Wrexham, Wales, July 8, 1721.

See B. C. Steiner, *Two New England Rulers of Madras*, 1902.

YALE UNIVERSITY, a privately endowed university, at New Haven, Conn. The third oldest university in the United States, Yale was founded as a Collegiate School in 1701 by a group of Connecticut ministers who had grown dissatisfied with the organization of Harvard College. The first rector of the Collegiate School was the Rev. Abraham Pierson, whose parsonage at Killingworth, Conn., served as the original classroom. The school's first commencement was held at Saybrook, Conn., Sept. 16, 1702. In 1716 the Collegiate School was moved, after considerable debate, to New Haven. In 1718 it adopted the name Yale College in commemoration of generous gifts of books and salable merchandise sent to it by ELIHU YALE. High points in Yale's development during the 19th century were: the founding of the Medical Institution, School of Theology, Law School, *Yale Literary Magazine*, the first undergraduate periodical in America; Graduate School, which conferred the first American degree of Ph.D.; Sheffield Scientific School; School of the Fine Arts; the introduction of a partial elective system of studies; the reincorporation as Yale University; the founding of the Alumni University Fund Association; School of Music, and the School of Forestry. Under Pres. ARTHUR TWINING HADLEY, 1899-1921, Yale became a university in the true sense, particularly after the reorganization effected in 1919-

YACHTING



EDWIN LEVICK PHOTOS

FAMOUS AMERICAN AND ENGLISH RACING YACHTS

1. The *Enterprise*, winner of America's Cup in 1930, owned by a syndicate of American yachtsmen.
2. The *Shamrock V*, English challenger in 1930, owned by the late Sir Thomas Lipton.

20. The Department of Drama achieves increasingly noteworthy results in the field of COLLEGE DRAMATICS. Another recent feature is the Institute of Human Relations, founded in 1929. Yale now includes the following schools: the Freshman Year, Yale College, Sheffield Scientific School, Graduate School, School of Law, School of Medicine, Divinity School, School of Nursing, School of the Fine Arts, School of Forestry, and the Institute of Human Relations. The number of students enrolled in 1930-31 was 5,338. The teaching staff of 754 members was headed by Pres. JAMES ROWLAND ANGELL. Women are admitted to the graduate and professional schools. The university's total assets amounted to \$82,856,840. The most noted of Yale's buildings are the Harkness Memorial Quadrangle, with the stately Harkness Memorial Tower; Marquand Chapel; Battell Chapel; Observatory; Elizabethan Club; Yale Bowl, accommodating 74,786 people; Peabody Museum of Natural History; Gallery of Fine Arts; Sterling Memorial Library (1,540,000 volumes); and the various gymnasiums and boat-houses.

YALTA, leading health resort on the southern Crimean coast, of the U.S.S.R., picturesquely located in the Utchan-Su and Guaz river valleys. Almost enclosed by mountains it has a mild climate. The city was an ancient Greek settlement and even to-day has numerous Greeks, many of whom are engaged in grape growing. Yalta's environs are crowded with estates, summer residences and sanatoria, to which flock Russians from all parts of the Union. Its celebrated Eastern Museum was formerly the Emir of Bokhara's palace. Pop. 1926, 28,838.

YAM, a name generally misapplied in the United States to certain large types of sweet potato. There are about 200 species of wild yams (*Dioscorea*), mostly twining, herbaceous perennial vines, grown chiefly in the tropics. Some species are grown for their subterranean or aerial tubers which are used for human or animal food; others are planted for their ornamental foliage. Tubers of the winged yam (*D. alata*) often reach 6 or 8 ft. in length and 100 lbs. in weight. The Chinese yam or cinnamon vine (*D. Batatas*) is grown for its attractive foliage and small fragrant flowers as far north as New York. The air potato (*D. bulbifera*), popular in the South, bears in the angles of the leaves odd-shaped potato-flavored tubers that sometimes attain a length of 12 in. and a weight of several pounds.

YAMA, in Hindu religion, son of Vivasvat who personified the sun, and of the sūn maiden Saranyu. Yama was the god who ruled the dead. Yami was his twin sister. He dwelt in heaven near the sun, and Agni, god of fire, led to him the souls of the dead. Two dogs are his messengers, and spirits must pass them to reach the presence of the god. Either he or his messengers draw the souls from the bodies of the departed with a noose. Yama is represented as green in color and wearing red robes. He has four arms and is seated on a buffalo, crowned and holding a club and noose.

YAMAGATA, ARITOMO, PRINCE (1838-1922), Japanese statesman, was born in the Choshu feudal district of an ordinary Samurai family. He was among those who took an active part in the reconstruction of Japan from the beginning of the modern period, though his influence steadily was on the conservative side, becoming more so in his later years. He served twice as Premier, and was one of the Genro group after the death of the Emperor Meiji. (See MEIJI TENNO.) He was made a prince in 1907. He died, after some years of retirement, in 1922.

YAMHILL or **YAMEL**, a North American Indian tribe of the Kalapooian linguistic stock, probably now entirely extinct. They lived on Yamhill Creek, a western branch of the Willamette River in Oregon.

YANAN, a North American Indian linguistic family consisting of a single tribe formerly occupying the district from Round Mountain near Pit River, Shasta co., to Deer Creek, Tehama co., Calif. Their nearest neighbors were the Wintun with whom they were frequently in disagreement. Practically the entire group, estimated at about 3,000, was annihilated in a massacre by miners in 1864, leaving less than 1,000 survivors. The last survivor died in the present century.

YANCEY, WILLIAM LOWNDES (1814-63), American political leader, was born at the Falls of the Ogeechee, Ga., Aug. 10, 1814. He attended preparatory school and was for one year at Williams College at Williamstown, Mass. After studying law in Sparta, Ga., he was admitted to the South Carolina bar in 1834, beginning practice in Greenville, S.C. Upon his removal to Cahawba, Ala., 1837, he gave up the practice of law to become a cotton planter. He also acted as editor of the *Cahawba Democrat* and the *Cahawba Gazette*. In 1839, he moved to Wetumpka, Ala., where he resumed the practice of law. He was a Democratic member of the State House of Representatives, 1841, and of the State Senate, 1843. He was elected as a Democrat to fill a vacancy in the 28th Congress, and reelected to the 29th Congress, serving from Dec. 2, 1844 to Sept. 1, 1846 when he resigned with the assertion that northern Democrats were subservient to sectional interests which were antagonistic to Southern welfare. He moved to Montgomery, Ala., in 1846. Yancey in 1848 at the Democratic National Convention introduced his doctrine which was nationally famous as "The Alabama Platform" (since the Alabama Democratic Convention had endorsed it) to the effect that it was the duty of Congress not merely to permit slavery in the territories but actively to protect it there. He argued for the inclusion of his theory in the platform and upon its rejection by the Convention, and the nomination of Cass, a believer in squatter sovereignty, Yancey rose and left the hall accompanied by a single follower. Yancey possessed a charming voice which combined with a handsome appearance to make him an unusually effective orator and from 1848 until 1861, he spoke constantly and vehemently in defense of "Southern rights." He deplored all compromise

and in 1860 at the Democratic National Convention at Charleston, S.C., he was the acknowledged spokesman for the planting South in their protest against the platform dictated by Douglas. When he had finished his speech, Yancey left the Convention Hall as he had 12 years earlier, but on this occasion most of the delegates from the states which later seceded left with him. He announced in 1860 as he had in 1856 that the election of a Republican president would be the signal for secession. For it he voted as a delegate to the State Constitutional Convention at Montgomery, Jan. 7, 1861. He went to Europe in 1861 as chairman of the commission to present the Confederate cause to the governments of England and France. Feb. 21, 1862 he was elected to the first Confederate States Senate and July 28, 1863 he died at his plantation near Montgomery.

YANGTZE KIANG, the largest river in China, and one of the largest in the world. The river rises in the Central Asian mountains, the sources being some 16,000 ft. above sea level. For the first 400 mi. it runs on the high Tibetan plateau, then drops 6,800 ft. in 150 mi. as it comes down onto the Szechuan level at Batang on the Tibeto-Chinese border 9,000 ft. above the sea. For 1,000 mi. from Batang, the river winds south, east, north, south and east until it reaches Suifu, 1,700 mi. from the sea and 1,000 ft. above sea level. In the next 200 mi., Suifu to Chungking, the fall is about 300 ft. Between Chungking and Ichang, a distance of 460 mi., the river passes through the Yangtze gorges, falling some 500 ft. down out of the mountains and into what may be called the beginning of its plain course. From Ichang to Hankow the distance is 370 mi., with a fall of 100 ft., and from Hankow to the mouth at Woosung, while falling another 100 ft., the river runs approximately 600 mi. The Yangtze Kiang has many tributaries, among these being the Yalung Kiang and the Min Kiang in its upper reaches, the Kialing Kiang, which waters eastern Szechuan Province and enters the Yangtze at Chungking, the Wu Kiang and the Hoh Kiang which come from Kweichow Province, the streams from the Tung Ting Lakes in Hunan Province which feed the Yangtze 120 mi. above Hankow, and the Han Ho which enters at Hankow and gives that city its name.

The total length of the Yangtze Kiang is approximately 3,200 mi., as compared with 2,486 mi. for the Mississippi. The annual mean discharge of the Yangtze is 1,050,000 cu. ft. per sec., while a maximum of 2,532,000 has been recorded, compared with a mean discharge for the Mississippi of 225,000 cu. ft. per sec. and a maximum recorded of 1,617,000. The basin of the Yangtze is approximately 750,000 sq. mi., as compared with 1,232,000 for the Mississippi basin. The difference between high and low water at the central river ports is very great; at Chungking the difference between the average minimum and average maximum levels is fully 100 ft.; at Hankow, the difference between low and high water averages something over 40 ft., with not infrequent

rises to over the "flood level" of 46 ft. In the late summer of 1931, the river of Hankow rose to over 54 ft., at the time of the great flood. High water comes in the summer, owing in a large part to the melting of the snows in the mountains of the upper reaches of the Yangtze and its tributaries. The river, after leaving the upper mountains, carries considerable quantities of silt, which causes some difficulties from Hankow down and particularly near the tidal influences.

Junk traffic is heavy on the river all the way from the mouth to Suifu, and also on the many tributaries. Steamers up to five and six thousand tons navigate the river as far as Hankow, and smaller steamers of ordinary construction go up to Ichang. Specially built steamers now ply between Ichang and Chungking, and steam and gasoline launches are in use for some distance above Chungking and on the Kialing in Szechuan.

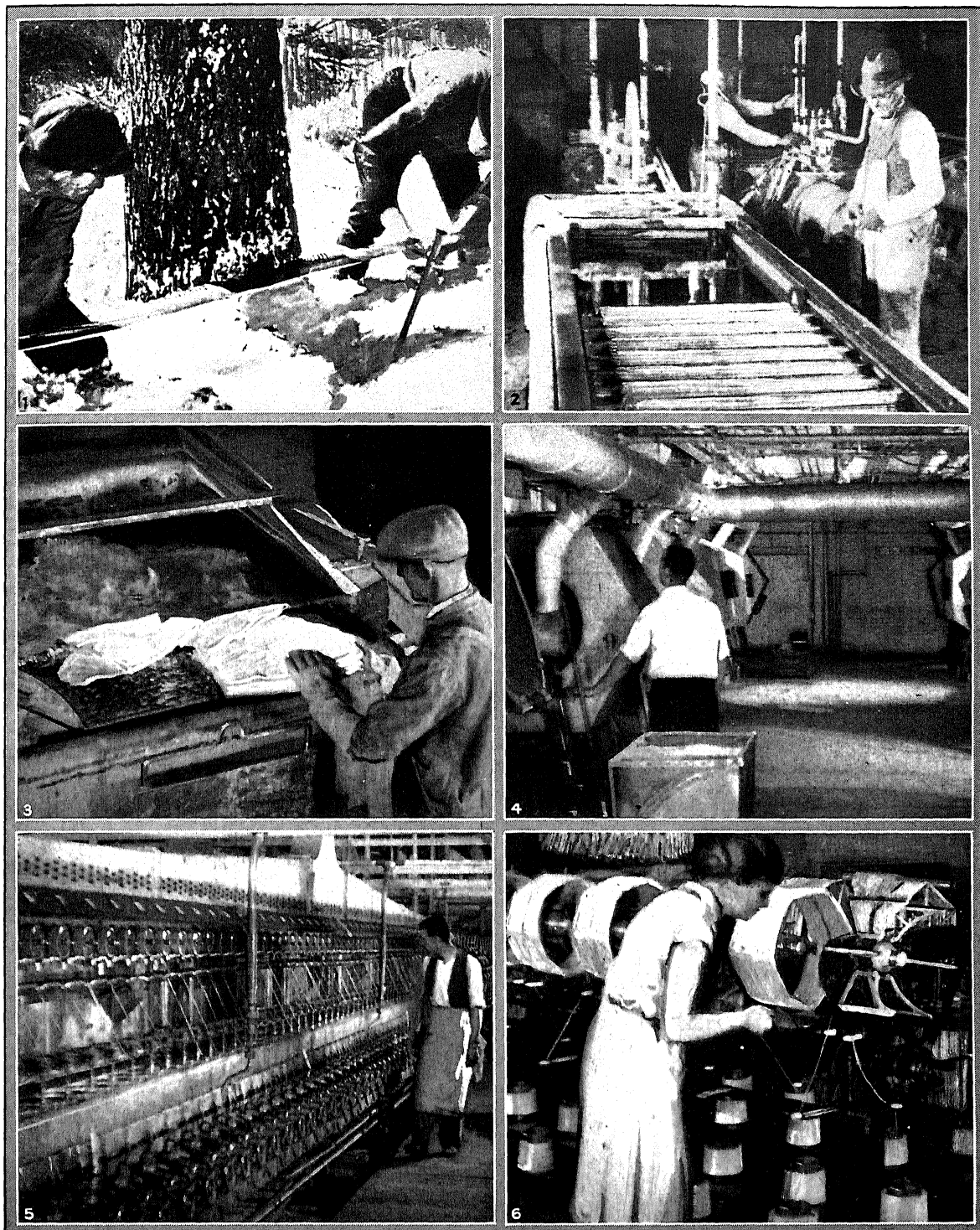
Economically, the Yangtze basin is the heart of China. It is larger and richer, area for area, than the Huang Ho basin to the north or the Si Kiang basin to the south. The climate is temperate, the soil rich and the rainfall adequate so that the region is agriculturally very productive. The area contains substantial amounts of coal and iron, particularly in the general Hankow or central Yangtze section. The Yangtze itself and its tributaries, and the many canals which have been built, furnish a far-flung system of excellent means of communication and transport.

YANKEE, a term used originally of a citizen of New England, but applied by foreigners, chiefly Europeans, to any citizen of the United States. During the Civil War the people of the South derisively called the people of the North "Yankees." There is a difference of opinion as to the origin of the term, but one theory is that it is a corrupt form of "English," as used by the Indians to denote the colonists. The Massachusetts Indians are said to have used the word "Yenghees" or "Yenkees," when speaking of their English neighbors. Another belief is that "Yankee" comes from a corrupt form of "Anglais" as used by the Canadian Indians who came in contact with the French. Still another theory is that the term comes from "Jankin" (diminutive "John"), a term said to have been used by the New York Dutch of the English colonists of Connecticut.

YANKTON, a North American Indian tribe of the Siouan linguistic family forming one of the seven primary divisions of the DAKOTA. They were an important factor in the history of the Northwest during the first half of the 19th century when they lived principally on the east bank of the Missouri River in South Dakota and western Iowa. They are closely related to the YANKTONAI and are probably an offshoot of that tribe, and like them migrated from northeastern Minnesota.

YANKTON, a city in southeastern South Dakota, the county seat of Yankton Co., situated on the Missouri River, near the mouth of the James River, about 60 mi. southwest of Sioux Falls. Bus and

YARNS, SYNTHETIC



COURTESY VISCOSE CO., NEW YORK CITY

THE MANUFACTURE OF ARTIFICIAL SILK

1. Felling the spruce or pine that provides the raw material for rayon, a form of artificial silk. 2. Soaking the sheets of wood pulp in a caustic soda solution, the process called mercerising. 3. Grinding the pulp sheets into fine, white

particles, chemically alkali cellulose. 4. Preparing xanthate cellulose. 5. Machines spinning the viscose solution into silk thread. 6. Winding the annular cakes of thread from the spinning machine into skeins.

truck lines and three railroads serve the city, which is a shipping market for corn and live stock. Yankton has fireworks, box, beverage and egg crate factories, creameries and poultry houses. Pierre Dorion came here in 1780, and married an Indian. He was the guide for Lewis and Clark, and his son went to the coast with the Astor Expedition. In 1858 the townsite was located, and in 1861 Gov. Jayne made it the territorial capital. Pop. 1920, 5,024; 1930, 6,072.

YANKTONAI, one of the seven primary divisions of the DAKOTA, belonging to the Siouan linguistic family. Their hunting-grounds were between the James and Missouri rivers in North Dakota. Like the YANKTON they migrated from northeastern Minnesota, probably at the beginning of the 18th century. They did not live in permanent villages but erected temporary lodges of well-dressed and beautifully decorated skins.

YANNINA, or Janina, a town in the Greek Epirus, situated amid picturesque mountains on the shore of the lake of the same name. In the latter 18th and early 19th centuries it flourished as the capital of the Albanian despot Ali Pasha who became known throughout Europe as the Lion of Yannina. In Ali's day the city had imposing palaces and the minarets of 16 mosques rose above its fantastic streets and houses. After his death in 1823 it declined in importance but remained as the seat of the vilayet of the same name. It is now a lively trading center, the principal articles of manufacture being morocco and gold-woven and silk stuffs. Pop. 1928, 20,485, including many Albanians and some Jews.

YAP, an island of the Pacific Ocean, belonging to the Caroline group, which was formerly a German possession but since 1919 mandated to Japan. Yap has an area of 79 sq. mi. and derives its importance chiefly from the fact that it is a station of two important cable lines, one running from the United States directly to the Dutch East Indies, and one from Yap itself to Shanghai. Pop. 6,799.

YAP CONTROVERSY. The island of Yap, in the Caroline group of the Pacific Ocean, an important terminus of cable lines, passed from German ownership to Japanese control by mandate of the SUPREME COUNCIL, May 17, 1919. The United States protested, arguing for internationalization of the cables; but the Council of the League of Nations expressed its inability to reopen the subject. The United States then secured the provisional approbation of Great Britain, France and Italy to its contention that the failure of the United States to ratify the Treaty of Versailles did not deprive it of any rights in the disposal of the German colonies. At the WASHINGTON CONFERENCE plenipotentiaries of Japan and the United States reached an agreement, announced in Dec. 1921, whereby the United States secured free and equal access to the cable between Yap and Guam; the right to establish a cable or wireless station on the island with free communication; admission of American missionaries to the territory under mandate; and stipulations for the protection of

American property. This treaty was confirmed and extended by the Pacific Cable Treaty of 1922, signed by the United States, Japan, Great Britain, France, Italy and the Netherlands, distributing the cables as follows: from Yap to Guam, to the United States; Yap to Shanghai, to Japan; Yap to Menado, to the Netherlands.

YAQUINA, the most important tribe of the North American Indian Yakona linguistic stock. They occupied formerly the shores of Yaquina River and Bay in western Oregon. In 1931 the few mixed-blood survivors were on the Siletz Reservation in Oregon.

YARMOUTH, or **GREAT YARMOUTH**, a municipal borough, watering-place, and seaport of Norfolk, England, situated on a long, narrow peninsula between the North Sea, Bure River, and the Breydon Water, 121 mi. northeast of London. Since ancient times a center attracting fishermen from the Cinque Ports, the old town has many historical and literary associations. The parish church, one of the largest in England (founded 1101), contains a memorial to Admiral Sir Robert Holmes who, in 1664, captured New York City from the Dutch. The church was badly damaged by Cromwellians, as were the town halls and gateways, but some fine ancient buildings have survived. Pop. 1921, 60,700; 1931, 56,769.

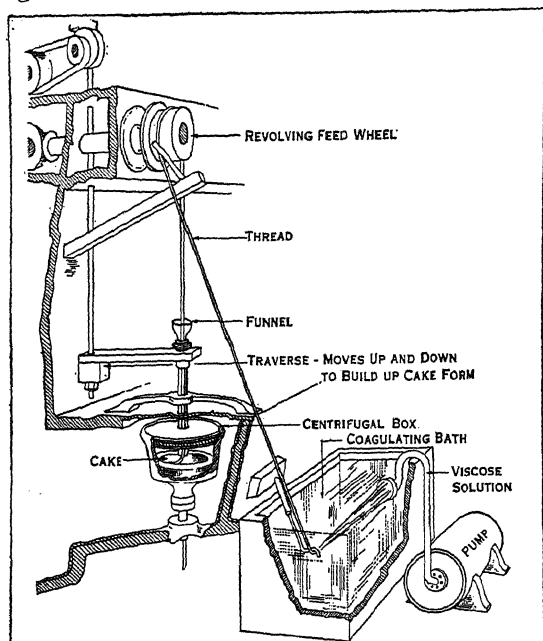
YARMOUTH, a town and port of Yarmouth Co., Nova Scotia, Canada, situated on the Bay of Fundy about 200 mi. by road southwest of Halifax. There is regular steamship service to Boston, Mass., and St. John and in summer to New York City, and also heavy exports in lumber, fish and berries. Agriculture in the environs is largely confined to the cultivation of berries. The manufactures include ship-building, engineering, iron casting and woodworking. Yarmouth contains the county buildings and has good schools. Pop. 1921, 7,073; 1931, 7,055.

YARN. See SPINNING.

YARNS, SYNTHETIC. Four varieties of synthetic yarns (artificial silks or rayons) are now in use: nitrate, cupra, viscose, and acetate. Chardonnet first commercialized the nitrate process in 1891. The first plant for the manufacture of cupra yarn was erected in 1898. The viscose process was commercialized in 1901. Acetate filaments were made experimentally in America in 1895, but acetate yarn was not successful until about 1921. The first American synthetic yarn plant was erected in 1911 and in 1930 there were 30 plants in the United States.

There are many variations in the methods of manufacture but in every case the parent material is purified CELLULOSE, cotton linters or wood pulp. This cellulose is brought into solution in various ways and the methods of solution constitute the major differences in the four methods of manufacture. In addition, there is an important difference between the acetate process and the other three methods. In the case of viscose, cupra, and nitrate, the final product is chemically identical with the original cellulose, while in acetate the product is a chemical compound of cellu-

lose. This difference is reflected in reaction to dyes and in other properties. The cellulose solution is forced through fine holes in a spinneret into a medium which coagulates the cellulose in the form of fine filaments. In the cupra and viscose processes, the cellulose solution is coagulated by passing it into water or an acid bath. In the nitrate and



COURTESY THE VISCOSE CO.

SIMPLE SET-UP FOR THE PRODUCTION OF VISCOSE YARN

acetate processes, the solvent solutions of the cellulose nitrate or acetate are forced into warm air which evaporates the solvent. The filaments are twisted together to form the yarn, and the viscose, nitrate, and cupra yarns are purified, bleached, oiled, etc. Many brands of each type are available, each differing somewhat from all others.

WORLD PRODUCTION OF SYNTHETIC YARNS IN POUNDS FOR 1930

United States	119,000,000
Italy	65,150,000
England	48,825,000
Germany	48,500,000
Japan	35,500,000
Holland	16,000,000
Switzerland	10,650,000
Belgium	10,450,000
All others	62,700,000
Total	416,775,000

WORLD PRODUCTION OF SYNTHETIC YARN BY PROCESSES

(In thousands of pounds and percentages)

Process	1929	1930
Viscose	347,298 85.9%	367,975 88.3%
Acetate	26,097 6.5%	28,700 6.9%
Cuprammonium	15,920 3.9%	11,600 2.8%
Nitrate	14,840 3.7%	8,500 2.0%
	404,155	416,775*

* In the United States the 1930 production was: viscose and nitrate 90%, acetate 8% and cuprammonium 2%.

Many improvements in the processes of manufacture have been made and the best synthetic yarns now so closely resemble real silk that it is impossible to distinguish between them except by test. The price of viscose yarn has decreased about 62.5% in the period of five years between 1926 and 1931. C. E. M.

YAROSLAVL, administrative center of Yaroslavl district in the heart of the Ivanovo-Industrial Region of the R.S.F.S.R. Situated on the Volga River, it is an important textile city and outstanding in chemical and leather manufacture. Its economic preeminence is largely due to its situation on a navigable waterway and three important railway lines. Yaroslavl is the oldest Volga town, founded in the 11th century, and annexed to Muscovy in the 15th. The first linen mill and the first theater in Russia were established here early in the 18th century, and, a little later, the first private printing shop. The Monastery of Our Saviour is one of the oldest in Russia, dating from the 12th century. A distinctive 17th century church and a number of museums are other sights of the town. Large tobacco factories, an auto-repair works and sawmills are the principal plants. An automobile plant here is undergoing extensive reconstruction. Pop. 1926, 114,277.

YARROW (*Achillea Millefolium*), a perennial herb of the composite family called also milfoil. It is found almost throughout the north temperate zone with numerous floral varieties in cultivation. The simple stem, 1 to 3 ft. high, bears long narrow leaves cut into innumerable segments and white or reddish flower-heads in showy flat-topped clusters. Yarrow was formerly highly prized for the treatment of wounds; it was anciently named for Achilles to whom tradition attributed the discovery of its healing properties.

YAVAPAI, a North American Indian tribe, speaking a language of the Yuman linguistic stock. They are known also as Apache Mohave and Mohave Apache. Prior to their removal to the Rio Verde Agency in 1873, the Yavapai claimed the Verde Valley and the Black Mesa from the Salt River to Bill Williams Mountain, in western Arizona, as their territory. Their aboriginal range appears to have been farther to the west along the Colorado River. In 1875 they were transferred to the San Carlos Apache Agency but early in the present century returned to their former home on the Rio Verde, where they now live a wretched, roving existence, living on the proceeds of work as day laborers.

YAWL. See YACHT.

YAZOO, an extinct North American Indian tribe belonging to the Tunican linguistic stock. They formerly occupied a small village on the Yazoo River. Like the Natchez, the Yazoo and the related Koroa attacked the French in 1729, as a result of which both tribes probably joined the Chickasaw and Choctaw and were thus submerged.

YAZOO CITY, a city in western Mississippi, the county seat of Yazoo Co., situated on the Yazoo River, 40 mi. northwest of Jackson. It is served by buses

and the Yazoo and Mississippi Valley Railroad. There is an emergency airport. Yazoo City is a commercial center at the gateway of the fertile Delta between the Yazoo and the Mississippi rivers. The chief crops are corn and cotton. The city has cotton, cottonseed oil and hardwood lumber mills. Yazoo City was settled about 1843. Pop. 1920, 5,244; 1930, 5,579.

YAZOO CLAIMS, a complex controversy between Georgia and the United States, and between Georgia and various private claimants, over title to a tract of land extending from East Florida to the Mississippi. In 1785 the legislature of Georgia formed the strip immediately east of the Mississippi into Bourbon County, and in 1789 sold lands in this region to three companies capitalized by citizens of Virginia and the Carolinas. Provisions for the acceptance of the depreciated paper money of the State of Georgia in payment for these lands were abrogated after a time by the state legislature. And the land companies were left without recourse by the adoption of the 11th Amendment to the Constitution, which declared the non-suability of a state without its own consent. In 1794 the state legislature sold the Yazoo tract, disregarding the previous sale of part of the tract, to four land companies for \$500,000; the area conveyed was about 35,000,000 acres. That every member of the legislature save one was a shareholder in one or more of the purchasing companies became public knowledge. A new legislature, elected in 1796 in the full season of public indignation, declared the sale null and void. In 1798 a convention made the nullification a part of the new state constitution.

The United States interposed its claim to title in 1798, establishing the Territory of Mississippi and providing for a joint commission to adjust the claims of Georgia and the United States. The commission, composed of Madison, Gallatin, Levi Lincoln and three Georgians, reported a settlement whereby Georgia was extended to the west of its present boundary; \$1,250,000 was to be paid to Georgia from the proceeds of land sales in the territory; and 5,000,000 acres of land were set aside to satisfy claims under the several sales acts of the Georgia legislature. The arrangement, submitted to Congress for ratification in 1803, was bitterly assailed by John Randolph of Roanoke; it was defeated, and whenever reintroduced was again defeated by Randolph. Intense personal animosities between Randolph and Madison (*see* **QUIDS**) threatened serious cleavage in the Republican party. The Supreme Court decided in 1810 (*see* **FLETCHER vs. PECK**) that titles of the land companies to Yazoo lands were valid. In 1813 Randolph failed of reelection to the House, and the next year Congress provided for the payment of \$8,000,000 to the claimants under the Georgia sales. In 1817 the Treasury reported a final settlement, \$4,282,151 having been paid.

YAZOO RIVER, a river of Mississippi, formed by the junction of the Tallahatchie and Yalobusha in Leflore Co. Following a very sinuous course, it

flows south and southwest through Holmes, Yazoo and Warren counties and enters the Mississippi at Vicksburg. It is an alluvial stream with a sluggish current carrying much fine sediment and is navigable throughout its entire length of 178 mi. In 1929 the river carried cargoes aggregating 64,824 tons, 82% of which were timber and timber products. The area drained covers 10,940 sq. mi., much of which is forested.

YEAR, the time consumed by the earth in making one complete revolution in its orbit around the sun, as measured from equinox to equinox, and equal to 365 days, 5 hours, 48 minutes, 46 seconds, or 365.2422 days. This is the year used in our **CALENDAR**, and called tropical year by the astronomers. The true, or sidereal year, which is the time of a full revolution of the earth with reference to the stars is 20 minutes 24 seconds longer, owing to the precession of the equinoxes.

YEAR BOOKS. 1. A collection of annual reports, written in Norman French, of cases decided in the English courts of common law between 1292 and 1534. Published, translated and abridged at various times, these reports have revealed the origins of certain kinds of legal procedure. 2. Reports published regularly at the end of each year, summarizing world events or giving in compact alphabetical form all available data for the year on some particular branch of human activity. The **ALMANAC** is a notable type of the year book. Others are *Who's Who*, *The Statesman's Year Book*, *Poor's* and *The Social Register*.

YEAST (*Saccharomyces*), a genus of one-celled, colorless plants of microscopic size, ranked as the most important of the fungi because of their power to excite **FERMENTATION**. For thousands of years before their nature was understood, these prolific little plants were utilized in brewing, wine-making, and the raising of bread. Wild yeasts are very widely present in the air. In exposed moist foods of suitable temperature containing small amounts of sugar, they multiply with enormous rapidity, secreting an enzyme, or ferment, which transforms the sugar into alcohol and carbon dioxide. The plants are usually solitary, round, or oval bodies. However, when growth is very rapid, daughter-cells may begin to bud before separating from the parent, so that small clusters are formed. Yeasts long survive deprivation of food, moisture and warmth without losing their vitality, passing into a resting stage. They are killed by exposure to moist heat at 212° F.

Compressed yeast is cultivated by sowing selected varieties of wild yeasts in a warm mash made of dextrinized starch. The yeast cells rise to the top and are skimmed off, washed, freed from impurities, pressed to remove part of the water, and cut into cakes. Dried yeast is compressed yeast dried at a low temperature. Brewer's yeast is the top-yeast taken from the vessels in which beer and ale have fermented.

YEATS, WILLIAM BUTLER (1865-), Irish poet, dramatist and essayist, was born in Dublin, June 13, 1865. He studied painting, but found his

stronger inclination was toward literature, in which he has attained high distinction. His many books include poems, plays and literary and critical essays. Many of Yeats's plays have had notable success in Ireland, England and America. His poems cover a wide range in theme and style. The poet was one of the founders of the Literary Theatre in Dublin and has been a leading figure in the revival of Irish literature. Among his best known plays are *Kathleen ni Houlihan*, *The Pot of Broth*, *Land of Heart's Desire* and *Deirdre*. The chief distinction of his work lies in its reflection and poetic interpretation of the mystic and emotional qualities of the Irish nature. In 1923 he received the Nobel Prize for Literature. In 1927 Yeats published *Autobiographies*, a volume including *Reveries over Childhood and Youth* and *The Trembling of the Veil*.

YELLOW BACK, the common name for a species (*Lampsilis anodontoides*) of fresh water mussels of the family *Unionidae*, found in the Mississippi River system and about the Gulf of Mexico. It has an inflated, elongate shell, about 3 inches long, which is pointed behind. The external color is bright yellow-brown, and the beautiful nacre is purple or white. This shell, much used in making buttons, is known also as yellow sand shell.

YELLOWBIRD, a name sometimes given to the American goldfinch or wild canary and also to the yellow warbler called also summer yellowbird. In Great Britain the golden oriole is sometimes called yellowbird. See **GOLDFINCH**; **ORIOLE**; **WOOD WARBLER**.

YELLOW FEVER, an acute infectious disease of tropical and subtropical regions, transmitted by the bite of a certain mosquito, *Stegomyia calopus*. Until recently the causative agent was considered to be a spiral microorganism *Leptospira*, but evidence is accumulating which indicates that the real causative agent is a filter-passing virus.

When introduced into the body the causative virus multiplies for about five days before the appearance of symptoms. The liver cells swell so that the minute bile passages are closed, and their function altered so that their power of changing ammonia into urea is lost. Accordingly, the patient becomes jaundiced from the obstruction of the bile channels. The increase of unchanged ammonia in the blood causes serious symptoms, especially in the brain. The flat cells lining the small blood vessels are injured and minute hemorrhages occur into the tissues over wide areas. The secreting cells of the kidney are also injured, and the **PROTEINS** of the blood pass through into the urine. In addition to these symptoms, which may be closely correlated with physical findings, the disease is characterized by a high fever enduring about two weeks but broken by a two days' remission after the first several days. Other symptoms are abdominal tenderness, black vomit, and backache.

The treatment in the past has been largely directed toward the comfort of the patient.

Yellow fever is peculiar to warm climates, and is especially prevalent in Central America and the West

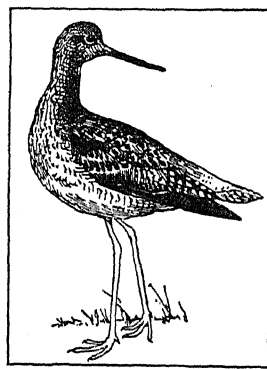
Indies. Newcomers, are more readily infected than natives. The most important measure in prophylaxis, however, is extermination of the *Stegomyia* mosquito. This is effected by covering water-tanks and establishing colonies of top-feeding minnows in pools, which eat the larvae of the insects. See also **ARMY, U.S.**, **MEDICAL SERVICE**; **REED, WALTER**; **TROPICAL MEDICINE**.

YELLOW-FIN, a valuable food fish (*Thunnus macropterus* or *Neothunnus catalinae*) of the **MACKEREL** family, called also yellow-finned albacore, abundant on the coast of southern California. In 1929 the commercial catch of yellow-fin amounted to 37,399,000 lbs., valued at \$2,200,000, utilized chiefly for canning, the product being known to the food trade as **TUNA**.

YELLOW JACKET, the common name for various species of small black and yellow social wasps. Most of these build paper nests in the ground or under some object lying on the ground. See **WASP**.

YELLOW KNIVES, or Tatsanottine, a sub-group of the **CHIPWEYAN** of the northern division of the American Indian. Athapaskan linguistic stock. They dwell on the northern and eastern shores of Great Slave Lake in Canada. Formerly they were nomadic hunters and were in frequent contact with Eskimo groups hunting inland. They manufactured and traded implements of copper, obtaining the metal along the banks of the Coppermine River.

YELLOWLEGS, the name applied to two American shore birds allied to the sandpipers because of the color of their conspicuously long legs. They are found along shores and in marshes. The lesser yellowlegs (*Totanus flavipes*), which breeds in Alaska and northern Canada and winters in southern South America, occurs in abundance in the Mississippi valley and along the Atlantic coast during migrations. It is about 11 in. long, with variegated brownish-gray and white plumage. Its note is a soft flute-like whistle. The similar but larger greater yellowlegs (*T. melanoleucus*) breeds from Illinois and Nebraska northward and ranges in winter from California and the Gulf states to Patagonia.



G. M. SUTTON. "BIRDS OF PA."
J. HORACE MCFARLAND CO. COPYRIGHT
GREATER YELLOWLEGS

YELLOWPLUSH PAPERS, THE, a series of sketches and essays by W. M. THACKERAY, first published in *Fraser's Magazine* in 1838. Purporting to be the memoirs of Mr. Yellowplush, a West End footman, they contain a generous share of humor and satire, several touches of tragedy and a great deal of fantastic spelling.

YELLOW RIVER, the river in North China called by the Chinese **HUANG HO**. Yellow River is simply the translation of the Chinese name.

YELLOWROOT, a name applied to various plants with conspicuously yellow roots, especially to the **SHRUB YELLOWROOT**, planted for ornament, and the **GOLDEN SEAL**, used medicinally, both native to eastern North America.

YELLOW SEA. See **CHINA SEA**.

YELLOWSTONE NATIONAL PARK, situated chiefly in northwestern Wyoming, is the largest national park in the United States and was the first of American natural wonderlands to be given park status. It was established by Congress Mar. 1, 1872 and had an original area of 3,348 sq. mi. On Mar. 1, 1929 the boundaries were revised giving the park a total area of 3,426 sq. mi. of which 3,139 sq. mi. are in northwestern Wyoming, 240 sq. mi. in Montana and 47 sq. mi. in Idaho. It is under the control and supervision of the National Park Service of the Department of the Interior.

The first recorded visit to the Yellowstone country was made in 1807 by John Colter of the Lewis and Clark expedition. The reported wonders of the region were violently disbelieved by the general public until 1870 when a government expedition was sent out under H. D. Washburn and N. P. Langford which established its existence for even the most incredulous.

Topography. Practically the entire region is volcanic in formation. The central portion is a plateau between 7,000 and 8,500 ft. above sea level. This plateau is surrounded on the south, east, north and northwest by mountain ranges rising 2,000 to 4,000 ft. above it. Both mountain and plateau are composed of material which was formerly ash and lava, possibly ejected from Mount Washburn. Positive evidence of volcanic origin can be easily observed in the black glass of Obsidian Cliff, the lava masses just below the summit of Mount Washburn, in Specimen Ridge on the Lamar River and in the brilliantly colored sands of decomposed lava in the walls of the Grand Canyon of the Yellowstone.

The Continental Divide passes through the southern part of the park in a general northwest to southeast direction and several large rivers, including the Yellowstone, the Snake, the Lewis, the Madison and the Shoshone as well as innumerable smaller ones, have their headwaters in the park, whence they start on their journeys toward the Atlantic or the Pacific.

There are also many beautiful lakes. Yellowstone Lake, the largest, is approximately 20 mi. long and from 5 to 15 mi. wide. Except where the mountain slopes are too precipitous, the park is well forested below the timberline with spruce, pine, and other evergreen trees.

Scenic Features. The chief features of the park are the geysers which are more numerous and greater in size than those of the rest of the world put together; the Grand Canyon of the Yellowstone, rivaling the Grand Canyon of the Colorado in beauty though not in size; the superb water falls, and the remarkable fossil forests, which include a species of *Sequoia*, found along the Lamar River.

There are six principal geyser basins, the Norris, Lower, Midway, Upper, Heart Lake, and the Shoshone Basins, all lying in the west and south central areas of the park. Their geysers vary greatly in size, character and action. Some, like the famous Old Faithful which performs every 65 minutes, the Daisy and the Riverside, spout with amazing regularity. Others are irregular. Some shoot their streams of water straight up with tremendous power; others spout at an angle or merely bubble and foam during eruption.

Marvelously colored hot springs, mud volcanoes and other strange hot water formations are scattered throughout the park. In certain places, notably at Mammoth, Norris, and Thumb, the hot water pours over beautifully incrustated terraces built up of white mineral deposits. These terraces are often large enough to have engulfed trees of considerable size. Diatoms and other microscopic algae grow on the sides of these terraces and paint them with hues of red, pink, and bluish gray which glow brilliantly in the hot water. In certain lights, the surfaces of these pools seem vividly colored, the deeper ones appearing an intense green or blue.

The Grand Canyon and Falls. Variegated volcanic coloring and the fantastic effects of erosion make the Grand Canyon of the Yellowstone an impressive sight. The Canyon is best viewed from Inspiration Point, a cliff which juts so far out into the chasm that it seems immediately above the foaming river 2,000 ft. below, or from Artist Point almost directly across the gorge. A kaleidoscope of colors varying from the deepest orange, pink, and crimson to faint lemon and pearly white is accented by the dark green of the forests above and the intense blue of the sky. Dominating all is the great cataract, twice as high as the falls of the Niagara, at the head of the canyon. Just before the Great Falls of the Yellowstone the Upper Falls descend in a narrow chasm 110 ft. in height.

The Specimen Ridge cliffs, 2,000 ft. high and extending for 20 mi. along the Lamar River, contain the most remarkable petrified trees in the park. Layers of upright petrified trunks indicate that in past ages successive forests grew to maturity only to be covered with volcanic ash and have other forests grow above them to meet the same fate. There are several other regions in the park which contain petrified trunks.

Yellowstone National Park is one of the largest and most successful wild life refuges in the world. It contains herds of deer, moose, elk, antelope, mountain sheep and American bison; also numerous groups of brown, black, cinnamon, and grizzly bears roam unmolested. More than 200 species of birds may be seen in the park and trout fishing in the lakes and streams is unexcelled.

Travel Routes and Facilities. The North or Gardiner entrance and the West Yellowstone Entrance are reached directly by rail. The Eastern or Cody and the southern entrances are reached by auto stage connections with railroad points. The National

Park-to-Park Highway and the Yellowstone Trail enter the park on the north at Gardiner and on the east at the Cody Entrance which is also reached by the Black-and-Yellow Trail and the Custer Battlefield Highway. The Atlantic-Yellowstone-Pacific Highway enters the park at the south.

All the important features of the park are reached by automobile roads and by an extensive system of horseback and hiking trails. Hotels, stores, camping grounds, auto transportation lines and other facilities and accommodations are operated in the park under contract with the Department of the Interior. The tourist season extends from June 20 to Sept. 19.

Educational Features. Yellowstone has four trailside museums. The museum at Old Faithful is devoted to the geology and physical geography of the geyser basin and to the local flora and fauna. The Norris Museum in the geyser basin of that name contains excellent exhibits explaining the thermic activity of the region and its petrology as well as the flora and fauna. At the Fishing Bridge auto camp the museum, which is considered a model trailside museum both as to architecture and installations, deals principally with the bird life and geology of the Yellowstone Lake region. The human history of the Yellowstone country is presented by means of photographs, charts, maps, transparencies and other source materials in the museum at Madison Junction. The trailside shrine at Obsidian Cliff enables visitors to understand the origin and interrelations of the volcanic glass of which the cliff is composed. Public lectures are given at stated times and at many places in the park by the park naturalists who also guide field trips and escort automobile caravans. Self-guiding nature trails have points of geologic and biologic interest well labeled. "Trailside Notes," a series of pamphlets giving brief but reliable statements regarding the natural history features and also drawings to assist in their location are available for several of the main travelled routes.

YELLOWSTONE RIVER, a stream of southwestern Montana. Its most remote source is in the Shoshone Mountains of Wyoming whence it flows northwestward about 50 mi. to Yellowstone Lake in Yellowstone National Park, which is the main source of the stream. Issuing from the north end of this lake, the river soon plunges over the Great Fall of the Yellowstone into its own Grand Canyon. Upon reaching the plains it flows east and northeast, becoming gradually wider, swifter and more turbid as it gathers the waters of the Big Horn and Powder rivers. After a course of 500 mi. it joins the Missouri at Buford, N.D. The area drained is approximately 67,500 sq. mi.

YELLOW-TAIL (*Seriola dorsalis*), a highly prized food and game fish, found on the Pacific coast from Monterey to Mazatlan. In the summer spawning season it is abundant around the Santa Barbara Islands. Like the amber fishes of the same genus, it has an oblong, moderately compressed body, about 3 ft. long, covered with small scales. The fairly large

mouth is filled with sharp teeth. Anglers find these fish most frequently on rocky coasts and catching them is considered great sport. Another deep-sea fish (*Elagatis bipinnulatus*), common in the West Indies, is also called yellow-tail because of its yellow and orange markings.

In 1929 the commercial catch of yellow-tail in United States waters, taken almost entirely on the Pacific coast, amounted to 3,255,000 lbs. valued at \$163,000.

YELLOWTHROAT, a genus (*Geothlypis*) of small song birds of the wood warbler family (*Compsothlypidæ*). The best-known species, the Maryland yellowthroat (*G. trichas*), is found throughout the eastern states and adjacent Canada, wintering southward to the tropics. It is about 5 in. long, olive-green above, with a black facial mask, bright yellow on the throat and breast, and whitish below. Active in habit, with an energetic song, it frequents thickets along streams and swamps, feeding chiefly upon insects. It nests on or near the ground, laying three to five somewhat spotted white eggs. Several varieties occur in the southern and western states. *See also* WOOD WARBLER.

YELLOWWOOD, AMERICAN (*Cladrastis lutea*), a handsome profusely flowering tree of the pea family, called also yellow locust, yellow ash and virgilia. The tree, which in the wild state is rare and local occurring mostly along mountain streams from North Carolina to Arkansas, is widely cultivated as an ornamental. It sometimes grows 60 ft. high with slender, somewhat pendulous branches bearing pinnate leaves and beautiful bright yellow flowers in nodding, terminal clusters.

YEMASEE WAR, 1715-16, an Indian war of the Carolina frontier. It was an extensive revolt against the Carolinian trading regime, characterized by callous brutality, thieving and defrauding, a ruinous credit system, and enslavement of Indians. The continued infiltration of white settlers, especially cattle-raisers, was an additional grievance of the Yemasee. The uprising also involved the Creeks, probably instigators of the conspiracy; the Choctaw, and tribes of the Piedmont district. Beginning at Pocotaligo Town, Apr. 15, 1715, the Yemasee ravaged the border settlements in a campaign marked by massacre and torture, while their allies dispossessed or murdered the traders and confiscated the stores. South Carolina escaped complete ruin because of the energy of Gov. Charles Craven, the skill of the frontiersmen who commanded the militia, aid from neighboring provinces, and the conversion of the Cherokee to peace. A chain of garrisons was established along the fighting frontier, about 30 mi. from Charleston. Small affrays continued throughout the summer of 1715. In the autumn Lieut.-Col. Robert Daniel led a large expedition against the Yemasee, who fled toward Florida. Peace was established by the spring of 1716.

YEMEN, a region of southwestern Arabia extending from the Gulf of Aden to Hejaz in the north and bounded in the east by Hadramaut and the desert. The name applies to the British Protectorate of

Aden (*see* ADEN) and to the domains of the Imam Yahya, which is Yemen proper. Yemen proper without Aden comprises an area of 75,000 sq. mi. and has a population of about 3,000,000. Sana near the border of Hadramaut is the capital and has a population of approximately 25,000. Other large towns are Yerim, Taizz, Dhamar and Ibb. The chief products of Yemen are wheat, millet, barley, coffee and hides. The inhabitants, independent and freedom-loving, are largely Moslem Bedouins. Before the World War they were included in the Ottoman Empire, but constantly strove for independence and were never really subjected to the Ottoman rule.

YEN, W. W. (1877-), Chinese diplomat, born in Shanghai. He graduated from the University of Virginia in 1900. In 1906 he achieved the notable distinction of becoming compiler of examinations for the Hanlin Academy. In 1912 he entered the Ministry for Foreign Affairs, and the next year became Minister to Germany and Denmark, which position he held until 1920. In 1920 he became Minister for Foreign Affairs and acting Prime Minister at Peiping and during the succeeding years he held various cabinet positions in the Peiping administration, until he retired from active political life to go into business in 1928. Owing to much pressure from public opinion and the Government, he accepted the post of Minister to the United States in 1931, following the occupation of Manchuria by the Japanese in the autumn of that year.

YEN, Y. C. JAMES (1894-), Chinese scholar, was born in Hunan province. He graduated from Yale, and took an M.A. from Princeton in 1918. He served as Y.M.C.A. secretary with the Chinese labor corps in France, and during that time conceived the idea of developing mass education in China, through the utilization of the most common written characters. Returning to China, he organized the National Association for the Advancement of Mass Education in 1925, and since that time has been the leader in the very successful effort to give the common people at least the rudiments of reading and writing. Since 1928 the strictly educational work has been taken over increasingly by the regular educational authorities, and the efforts of Yen and his associates have been concentrated on studying rural conditions and attempting to work out practical solutions of the problems of the peasant. This work has been centered in Tingsien, not far from Peiping.

YEN, the Japanese monetary unit, a gold coin, equivalent to 49.8 cents at par. It equals 100 sen and 1,000 rin.

YEN HSI-SHAN (1882-), Chinese military leader, was born in Shansi province, and is a graduate of the Tokyo Military College. At the time of the Republican Revolution in 1911 Yen led the attack on the Manchu governor of Shansi, and the following year was made Military Governor of the province, under the Republic. He dominated Shansi in the succeeding years and kept it out of the civil wars in the rest of China until 1927, when he threw in his

lot with the advancing Nationalist forces, and led the attack which ousted the Manchu forces from Peiping in 1928. In 1930 he took part in a revolt against the Nanking Government which ended unsuccessfully. Since that time he has been in retirement. Yen came to be known as the "model governor" because of his success in maintaining order in Shansi, and his activity in developing education and industry in the province.

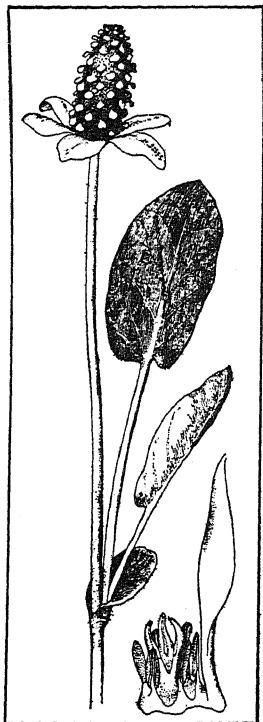
YENISEI, a river of Asiatic Russia, formed by the junction of the Shishkit and Belkhem, which rise in Mongolia. It flows north through the center of Siberia into the Kara Sea, a total course of 2,800 mi. A long estuary is formed at its mouth. The Yenisei is navigable for five months from its mouth to Minusinsk, but the Kara Sea is ice-free for only two months of the year. The Selenga, one of the head-streams of the Yenisei, is navigable far into Mongolia. When the ice breaks up and the snow melts, Siberian rivers spread their flood water abroad, and the Yenisei and Ob have no water parting between them. East of the Yenisei the land is higher, and rises to low plateaus and high plains trenched by the valley of the Arctic-seeking rivers. The Yenisei basin is drained by the right-bank tributaries, of which the chief is the Angara, flowing out of LAKE BAIKAL.

YEOMAN (F), title given to females who enlisted in the United States Naval Reserve Force during the World War. Finding an urgent need for clerical assistance in the Navy Department, at Navy Yards, naval stations and in naval districts, and after ascertaining there were no legal restrictions the Secretary of the Navy authorized their enlistment in certain ratings. Their pay and allowances for clothing were made the same as that of men holding similar ratings. At certain places, notably Washington, D.C., and Bremerton, Wash., they were organized into companies and drilled with rifles; while at the latter place, they manned boats under oars and sail. They were efficient and loyal. They are the only women entitled to membership in the American Legion. Eleven thousand enlisted in the regular Navy, 269 in the Marine Corps, and 1,713 in the Nurse Corps.

YERBA BUENA (*Micromeria Chamissonis*), a trailing evergreen perennial of the mint family with pleasantly aromatic foliage. It is native to open woods, chiefly near the coast, from southern California to British Columbia. The very slender stems bear roundish wavy-margined leaves and small white flowers on threadlike stalks produced singly from the leaf axils. The plant was used medicinally by the Mission Fathers whence the Spanish name signifying "good herb."

YERBA MANSA (*Anemopsis californica*), an upright perennial herb of the lizard-tail family native to wet saline soils from central California to western Texas extending southward to northern Mexico. The plant grows 1 to 2 ft. high from a creeping, aromatic rootstock bearing from 1 to 3 oblong, somewhat spicy leaves. The cylindrical, long-stalked flowering spike is encircled at the base with showy,

white, petal-like bracts giving the inflorescence the appearance of an anemone. An infusion of the root is used by the Mexicans and Indians in the treatment of skin diseases and other disorders.



FROM JEPSON, MAN. FL. PLANTS CALIF., COPYRIGHT

YERBA MANSA

Upper portion of flowering stem and detail of flower

YERBA SANTA (*Eriodictyon californicum*), an aromatic shrub with glutinous-resinous foliage belonging to the water-leaf family, called also mountain balm. It grows in dry mountain slopes often covering large areas from southern Oregon to central California. The somewhat woody stem, 2 to 8 ft. high, bears oblong, coarsely toothed leaves covered with a smooth, varnish-like resin above and a felty-wool below. The small, tubular, white or pale blue flowers are borne in terminal clusters. During the Spanish occupation the Indians and early settlers used the bitter aromatic leaves for medicinal purposes.

YERKES, CHARLES TYSON (1837-1905), American capitalist, was born at Philadelphia, Pa., June 25, 1837. He received a public school education

at Philadelphia, and began work as a clerk. He launched a flour and grain business, in which he continued until 1859 when he opened a stock brokerage, and became financially interested in the Philadelphia street-railway system. In 1871 he was indicted for misappropriating city funds when he refused to give a preference, after being forced to make an assignment, to the Philadelphia municipality for bonds sold on its account. He was sentenced to 33 months, but after serving a brief sentence was pardoned. He recouped his fortune and in 1881 obtained control of the street-car and elevated-railroad systems in Chicago, Ill. He gained national recognition for his work in the department of fine arts for the World's Columbian Exposition. In 1892 he gave funds to the University of Chicago to build and equip the Yerkes Observatory, near Williams Bay, Wis., which houses one of the largest refracting telescopes in the world. He died at New York City, Dec. 29, 1905.

YEW, a genus (*Taxus*) of highly ornamental evergreen trees or shrubs of the yew family. There are eight species widely distributed throughout the Northern Hemisphere, three of which are found in North America. They are mostly small or medium-sized trees with reddish-brown bark, linear, commonly two-

ranked leaves dark green above and pale green beneath, small usually axillary flowers and a characteristic, berry-like fruit composed of a bony seed surrounded by a fleshy, cup-shaped, scarlet disk. The English yew (*T. baccata*), the yew of history, native to Europe, North Africa and West Asia, grows 60 ft. high with a short thick trunk and spreading branches. The timber, highly valued for cabinet work and other purposes where great strength and durability are required, was formerly extensively employed for making the celebrated long bow used by English archers. Numerous foliage varieties of the English yew are widely planted for ornament as are also those of the more hardy Japanese yew (*T. cuspidata*) which attains a height of 50 ft.

The American yew (*T. canadensis*), often called ground hemlock, is found in woods from Newfoundland to New Jersey and westward to Manitoba and Iowa. It is a low, straggling shrub, seldom growing more than 5 ft. high, occasionally transplanted in shrubberies. The Florida yew (*T. floridana*), a small bushy tree sometimes 25 ft. high, is a rare species found only in western Florida. Of much wider range and greater economic value is the western or



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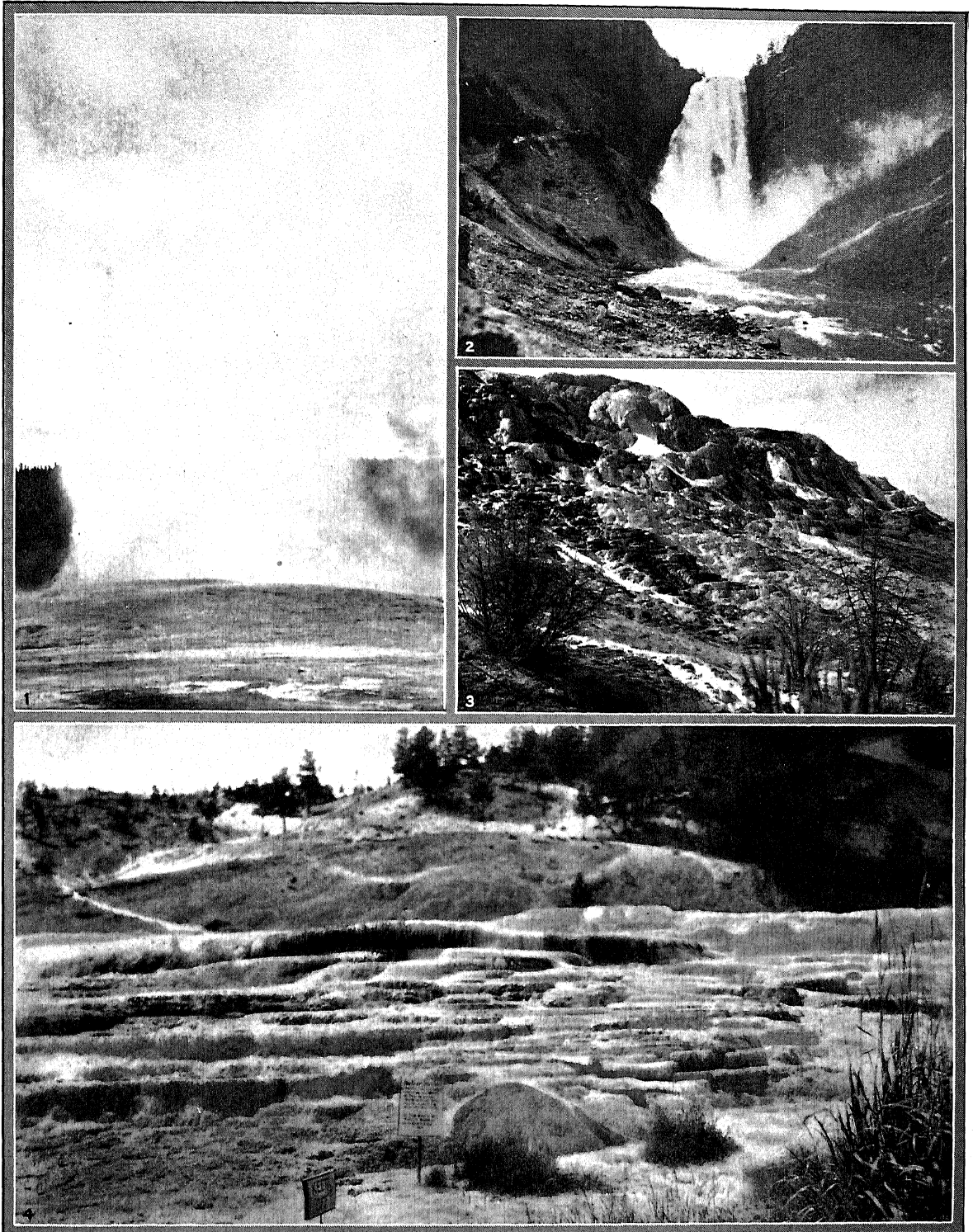
WESTERN YEW

Fruiting branchlet and section of fruit

Pacific yew (*T. brevifolia*) found from southern California to British Columbia and Montana and northward to Alaska. It grows usually 40 to 50 ft. high with a straight trunk 1 to 2 ft. in diameter but occasionally attains a height of 80 ft. and a trunk diameter of 4 ft. The hard, heavy, bright red wood, possessing great elasticity and strength, is widely used by the Indians of the northwestern coast for making bows, spear handles and paddles. This handsome yew is sparingly cultivated in western Europe as an ornamental tree.

A. B. J.

YELLOWSTONE NATIONAL PARK



COURTESY DEPT. OF COMMERCE AND INDUSTRY, CHEYENNE, WYO.

YELLOWSTONE NATIONAL PARK

1. Giant Geyser on the middle-west side of Yellowstone National Park. It hurls water 200 ft. in the air. 2. The lower falls of the Yellowstone River, Wyoming. 3. View

of the terrace-like geological structure at Mammoth Hot Springs. 4. Mammoth Hot Springs, showing the calcareous surface of the soil.

YEZD, a city of Persia and capital of a province of the same name, situated about 160 mi. southeast of Isfahan. A wall separates the two parts of the town which has muddy streets, low, badly built houses and some mosques. The only building of note, an old citadel, is now used as the residence of the provincial governor. Caravan routes go out from Yezd for Kerman, Isfahan, Bandar Abbas and other important points of Persia. Several small colleges are located here. The province produces silk, but almonds, opium and grain are the chief articles of trade. Weaving is the chief occupation of the inhabitants. Est. pop. 1930, 40,000.

YEZIDIS, so-called "Devil-worshippers" scattered throughout the region south of the Caspian Sea. The name Yezidi may come from Yazdan, a name for God, or have some historical connection with the khalif, Yezid, of Damascus. The appellation devil-worshiper is due to the fact that the Yezidis believe the Devil to have been God's agent in creation, being a fallen angel restored to favor. Many diverse elements combine in their faith: ancient Iranian, Assyrian, Manichaean, Moslem, Christian, etc. Christ is to them one of the angels. Mohammed is a prophet. They practice both circumcision and baptism. Their women go unveiled. They have a Scripture, al-Yalvah.

YIDDISH LANGUAGE, a language spoken by the Jews in eastern Europe and by many of their descendants in America, South Africa and Palestine.

The basis of the Yiddish language is an arrested Franconian German (*see* GERMAN, HIGH) dialect of the early Middle Ages enriched and developed by the absorption of HEBREW, ITALIAN and SLAVIC words, written in Hebrew characters. Besides original literary and scientific works published since the last quarter of the 19th century, a large number of Yiddish periodicals and newspapers appear in the three largest Yiddish-speaking centers, Russia, Poland and the United States. I. M.

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YIDDISH LITERATURE. Yiddish is the vernacular of Russian, Polish, Lithuanian, Galician and many German Jews in Europe, England and the United States. Basically it is a German dialect that in the course of centuries has become encrusted with Hebrew, Slavic, and English variations. Although written in Hebrew characters, Yiddish is of course to be distinguished from Hebrew itself which is the learned and the sacred language of the Jews and the language of the Jews in Palestine. *See* HEBREW LANGUAGE.

From the 14th to the 16th centuries, Yiddish appeared mainly in translations of the Pentateuch and of Hebrew prayers. One of the most famous of these translations was the *Tzenah Urenah* written by a 16th century Polish writer. The 17th and the 18th centuries witnessed many additions to the devotional literature of the Jews in Yiddish with many compendiums of ritual customs and Talmudical legends. But up to the 19th century, Hebrew was still very

extensively studied and used by the Jews, and this fact would naturally account for the paucity of works in Yiddish produced until 1800.

The decline in the use of Hebrew corresponded to the rise in importance of Yiddish. The attempt by Moses Mendelssohn to translate the Bible for the benefit of the unlettered Jewish masses resulted in the formation of the *Haskalah* movement for the intellectual uplift of the Jews. But it was not until the middle of the 19th century that a decided Yiddish literary movement arose. With the appearance of a number of versatile and original writers a rich and prolific literature began.

Among the more famous writers of this early period was S. J. Abramovitz (b. 1836), who wrote under the pen name of Mendele Mocher Seforim, or Mendele the Bookseller. His stories are for the most part quaint social satires.

Other important authors of this time were Linetzki, a novelist famous for his *Polish Youngster*, a tale of Chassidism or Hebrew mysticism; I. M. Dick (1803-93), writer of romantic novels; Goldfaden (1840-1908), poet and playwright who founded at Odessa the first Yiddish theater, 1878; N. M. Shaikevitch, who wrote under the pen-name of *Shomer* and produced many novels of popular appeal; I. L. Perez (1851-1915), satirist, poet, essayist, novelist and dramatist, a melancholy and mystic writer whose most famous work is a collection of tales called *Stories and Pictures*.

Unique in Yiddish literature is the name of Rabinovitch (1859-1916), who is better known by his pseudonym of *Sholem Aleichem*, the Hebrew equivalent of *pax vobiscum*. He settled and lived in Kiev, Russia, and wrote satirical short stories of such delicious, racy humor that he completely won the hearts of his readers and became perhaps the most popular of Yiddish writers. *Tobias the Milkman* reveals his rich humor and is a short story masterpiece that will live long in literature.

Among the writers who were prominent in the last decade of the 19th century were Z. Libin, author of short stories and plays about the trials and tribulations of the early immigrants to America; Jacob Gordin (1853-1909), who wrote about seventy plays and reformed the Jewish stage in this country; David Pinski, a playwright famous for such plays as *Yekel the Blacksmith*; Eliokim Zunker, writer of national songs; Morris Rosenfeld, a popular poet whose themes were taken from sweatshop and tenement and whose *Songs from the Ghetto* are well-known in English.

In the United States the growth of Jewish journalism was concurrent with the development of Yiddish literature. The most distinguished figure in Jewish journalism is Abraham Cahan (1860-), who has been connected with the *Jewish Daily Forward* practically since its founding in 1897. An important radical weekly is the *Freie Arbeiter Stimme* which has been edited by S. Yanofsky. The monthly *Zukunft* was edited by A. Reisin (1875-), famous poet and publicist, and M. Wintchevsky (1856-),

well-known as author of satires and philosophical epigrams. S. Blumgarten Yehoash (1870-) is another eminent poet, scholar and journalist.

Sholem Asch (1880-) has been perhaps the most celebrated contemporary Yiddish novelist and dramatist. Among his plays, the one produced in English as *God of Vengeance* is very widely esteemed. Peretz Hirschbein is the author of several important idyllic dramas. See also HEBREW LITERATURE.

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YIELD POINT. See STRENGTH OF MATERIALS.

YINKOW, or *Newchang*, a city near the mouth of the Liao River in Liaoning (formerly Fengtien) Province, China. Prior to the building of the railways in Manchuria, Yinkow was the principal ocean port of that region. It was opened to foreign trade by the treaty of Tientsin of 1858. Although it has lost its commercial leadership, it still remains the headquarters for a number of the principal British firms doing business in Manchuria.

Yinkow is the port through which agricultural products, wool and furs from western Manchuria chiefly are exported, the goods coming down the Liao River by small Chinese boats during the spring and summer, when the river is not frozen. Pop. 1929, approximately, 65,000.

YLANG-YLANG (*Cananga odorata*), a large tree of the custard-apple family native to India, Java and the Philippines, grown in warm countries for its very fragrant flowers. These yield the perfume known as ylang-ylang or Macassar oil. The tree bears drooping branches, oblong, sharp-pointed, glossy leaves and numerous large, greenish-yellow, pendant flowers in axillary clusters. Ylang-ylang is occasionally planted in southern Florida.

YMIR, in Scandinavian mythology, the frost giant. He sprang from the clouds, was slain by ODIN, Vili and Ve, and from his body the world was created. From his blood came the seas, from his bones the mountains. His hair became trees, his skull formed the heavens, his brain the clouds with hail and snow, and his eyebrows made the earth where man dwelt. Vili gave man reason and Ve endowed him with senses after Odin had given him life.

YOAKUM, a city in Lavaca and De Witt counties, south central Texas. It is situated 100 mi. east of San Antonio and is served by the Southern Pacific lines. There is valuable timber in the district. Cotton, corn and tomatoes are the principal crops. The city has railroad shops, marble works, flour mills, leather manufactures and tanneries. In 1915 the commission-city manager form of government was adopted. Pop. 1920, 6,184; 1930, 5,656.

YOH0 PARK, a Canadian national park, in British Columbia, area 507 sq. mi., established Oct. 10, 1886. The park is situated on the crest and western slope of the Canadian Rockies and is characterized by magnificent mountain scenery. From east to west

it is crossed by the narrow valley of the Kicking Horse leading to the pass of the same name over the Continental Divide discovered in 1858 by Sir James Hector in his search for a railroad route. The Canadian Pacific Railway, the first railroad to conquer the Rockies, and the Kicking Horse Highway leading into BANFF PARK follow this valley. Yoho Valley, is famous for its waterfalls. Takakkaw Falls, the most spectacular, issues from an icy cave high above the valley floor, rushes through a narrow gorge and plunges 1,400 ft. in one sheer drop to the Yoho River. Farther up the valley are Twin Falls, Laughing Falls, Point Lace Falls and others. At the head, are four great ice fields in addition to the many snow and glacier-capped peaks in the park. Emerald Lake and Lake O'Hara rival LAKE LOUISE in beauty of coloring and setting. The wild life of the park includes bear, elk, deer, caribou and mountain sheep and goats, all protected by game laws. Lakes and rivers are well stocked with fish. Yoho adjoins Banff National Park on the east, JASPER on the north and KOOTENAY on the south. The town of Field, on the main line of the Canadian Pacific Railway and the Kicking Horse Highway, is the seat of administration for the park.

YOJUANE, a sub-tribe of the North American Indian Tonkawa that lived in northern and central Texas and were culturally and linguistically similar to the TONKAWA. Like other Tonkawa tribes the Apache were their acknowledged enemies. They appear to have been one of the tribes at whose request the San Xavier Mission was established on the San Gabriel River in Texas. They are now extinct.

YOKOHAMA, the foremost trade port in Japan, situated on Tokyo Bay, 18 mi. below the capital for which it is an opening. The city is hilly in the rear and narrow at the harbor. Destroyed by the earthquake in 1923, Yokohama was almost completely rebuilt, and modernized with 33½ mi. of electric tramways, breakwaters, quake-proof buildings and concrete roads. The exports and imports of Yokohama have been estimated as two-fifths of the whole Empire's foreign trade. The port is the first call for ships sailing for the Orient from the United States, Canada and Honolulu. Exports include raw silk, Japanese cottons, stationery, lanterns, bamboo and bead blinds, curios, embroideries and silk and cotton crêpe, all sold in the numerous city shops catering to travelers. Yokohama was merely a thinly inhabited fishing village when it was opened to foreign trade in 1859. Commodore Perry had been received in 1854. Among the places of historical interest are the Daijingu Shrine, a Shinto structure designed after the Great Shrines of Ise, and Fudo Temple, both on Iseyama Hill. Fudo Temple is dedicated to Fudo-Myo-o, a Buddhist deva representing the supreme enlightenment over all lower passions. In 1927 the city expanded, absorbing seven villages and two towns, one of them Tsurumi, an industrial center lying between it and the capital, Tokyo. The absorption of these villages and towns increased the population of Yokohama by 109,000. Pop. 1930, 620,306.

YOKUTS, or **MARIPOSA**, a North American Indian linguistic stock comprising about 40 tribes, more properly villages, possessing distinct dialects. The Yokuts lived in the San Joaquin Valley, Calif., their territory including the area from the lower Sierra Nevada to the Coast Range and from Mount Pines and Mount Tehachapi to the Fresno and Chowchilla rivers. Physically they are said to resemble the Yuman tribes of southern California.

YONKERS, port city in Westchester Co., southeastern New York, situated on the Hudson River, adjoining New York City on the north. It is served by the New York Central Railroad, bus and truck lines, steamships and ferries. The principal manufactures are elevators, sugar and carpets. In 1929 the factory output was valued at about \$113,000,000; the wholesale trade proper amounted to \$16,231,170; retail trade, to \$61,183,577.

The site was bought from Indians by the Dutch West India Company in 1639. The city was incorporated in 1872. Philipse Manor-Hall, dating from 1682, is now a state museum. Washington's forces were quartered here during the American Revolution. Pop. 1920, 100,176; 1930, 134,646.

YORICK. 1. In Shakespeare's *HAMLET*, the king of Denmark's former jester, now dead and buried, whose skull Hamlet apostrophizes in the famous Gravediggers' Scene. 2. In Sterne's *TRISTRAM SHANDY*, the rural clergyman, a good and eccentric man. 3. Sterne's pseudonym in his *Sentimental Journey*.

YORK, county town, county in itself, and archiepiscopal city of Yorkshire, England, lying in the plain of the Ouse near its junction with the Foss, 188 mi. northwest of London. As *Eboracum*, of which extensive remains have been uncovered, it was the capital of Roman Britain, and there are indications of earlier settlement. The first archbishop of York was consecrated in the 7th century, and before Danish domination the city had become an educational center. Suffering at the Conquest, it grew prosperous with the Middle Ages, and to-day retains a medieval atmosphere in narrow, picturesque streets and ancient buildings. There are several early hospitals; quaint 14th century Holy Trinity Church; half-timbered St. William's College; the unique, restored, 15th century Merchant Adventurers' Hall; and the Perpendicular Guildhall which, in common with the churches, has remarkable stained glass. *See also* YORK CATHEDRAL.

Second only in interest to the cathedral are magnificent remains of St. Mary's Abbey upon Norman foundations, and the castle founded by the Conqueror. Clifford's Tower, reputedly surviving an earlier fortress, once imprisoned George Fox the Quaker. Industrially, modern York has among its many manufactures, breweries, tanneries, chocolate factories and motor engineering works. Pop. 1921, 84,039; 1931, 84,810.

YORK, a city in southeastern Nebraska, the seat of York Co., situated 50 mi. west of Lincoln and served by two railroads. The city is a shipping cen-

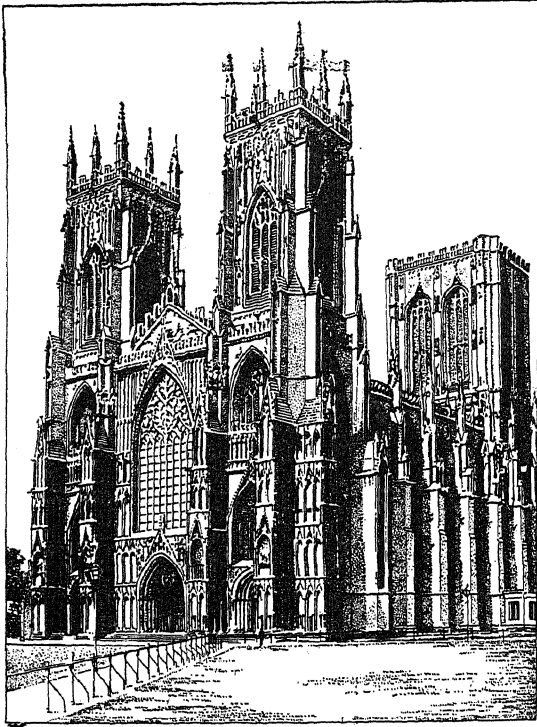
ter for grain and cattle. It is the seat of the United Brethren College of Nebraska. Pop. 1920, 5,388; 1930, 5,712.

YORK, a city and county seat of York Co., southeastern Pennsylvania, 28 mi. south of Harrisburg. It is served by the Pennsylvania, the Maryland and Pennsylvania and the Western Maryland railways and motor bus lines. It is the nucleus of a productive agricultural, industrial and commercial region. Diversified manufactures, consisting chiefly of a variety of machines, roofing paper, safes, tire chains, candy and cigars, were approximately valued in 1929 at \$87,500,000; the retail trade in the same year amounted to \$36,686,748. A colony of Germans, some English Quakers and Scotch-Irish in 1735 formed here the first permanent settlement in Pennsylvania west of the Susquehanna; the village was laid out in 1741 by Thomas Cookson for the Penn family and was named after York, England. It was the nation's capital from September 1777 to June 1778, while the British occupied Philadelphia. At York the Continental Congress passed the *ARTICLES OF CONFEDERATION*, received news of Burgoyne's surrender, issued the first national Thanksgiving proclamation, received Franklin's message of French aid for the colonies and commissioned LAFAYETTE and VON STEUBEN major generals; here Lafayette frustrated the CONWAY CABAL. York also saw Civil War maneuvers in 1863. Several historical landmarks, including a Quaker meeting-house built in 1765, are preserved. Incorporated as a borough in 1787 and chartered as a city a century later, York was put under a commission government in 1912. Pop. 1920, 47,512; 1930, 55,254; 3% foreign-born.

YORK, HOUSE OF, a royal family of England. The title, Duke of York, was first bestowed in 1385 upon Edmund de Langley, fifth son of Edward III, who also was father of John of Gaunt, of the rival house of Lancaster. The middle stage of the War of the Roses brought the Yorkist, Edward IV to the throne in 1461. The York-Lancastrian feud ended when in 1486 Edward's daughter Elizabeth married Henry VII. Between Edward's death in 1483 and Henry's accession two years later, the Yorkish Edward V ruled for two months, being murdered in 1483. The latter's throne was usurped before his death by his uncle, Richard III, who was killed in battle in 1485. His death ended the royal line of the house of York, but subsequently it became customary for the British monarch to create his second son, Duke of York.

YORK CATHEDRAL, the minster or cathedral of St. Peter at York, Yorkshire, England, and the largest of England's medieval cathedrals. It is built in the Early English and Decorated style. The small wooden church erected on the site in 627 for the baptism of King Edwin was succeeded by three other churches, the last of which was erected by the Norman archbishop, Thomas of Bayeux, 1070-1100. The present cathedral represents a rebuilding of Thomas of Bayeux's structure. Of the Early English transepts, built between 1216 and 1256, the northern is the more

admirable. The nave, chapter house and vestibule were completed between 1291 and 1340, and the nave, rich but not over-elaborate, is declared by some critics to be England's outstanding example of the Decorated Gothic style. It is the widest medieval



WEST END OF THE CATHEDRAL OF YORK

nave in England (105 ft.) and one of the highest (100 ft.), but its length is insufficient for an entirely satisfying balance. The ceiling is of wood, painted to resemble vaulting. The Decorated chapter house, octagonal and built without a central pillar, is a work of rare excellence, admirable especially for its glass and carvings. The retrochoir, choir and towers were added or rebuilt between 1361 and 1474. The west façade is particularly imposing, and the central tower impresses because of mass rather than height.

The glory of York Minster lies, however, in its stained glass. Alone among English cathedrals, York has kept almost all its ancient windows, and as a great part of the building is in the Decorated Gothic style with broad fenestration, a magnificent effect is produced.

YORKISTS. See ROSES, WAR OF.

YORKTON, a city and judicial center of north-eastern Saskatchewan, Canada, situated at an altitude of 1,655 ft., on the Canadian National and Canadian Pacific railroads, 130 mi. northeast of Regina, and 279 mi. northwest of Winnipeg. The industries include wholesale distributing firms, creameries, machine shops, implement factories and brick works. There are nine grain elevators. Adequate public works and utilities serve the city. Yorkton is the nearest dis-

tributing center to Hudson Bay. Pop. 1921, 5,151; 1931, 5,012.

YORKTOWN, a town of southeastern Virginia, the county seat of York Co., situated on the York River about 35 mi. northwest of Norfolk. Steamers and, at a nearby station, the Chesapeake and Ohio Railroad afford transportation. Yorktown was founded in the last decade of the 17th century and has several historic houses and buildings. Pop. 1920, 155; 1930, 480.

In the REVOLUTIONARY WAR, an army composed of 16,000 Americans and Frenchmen, led by Washington and Rochambeau, laid siege to Yorktown, in which Lord Cornwallis had entrenched himself. After a series of successful maneuvers by the allies, two British redoubts were captured, Oct. 14, 1781. Cornwallis, seeing that his position was becoming increasingly dangerous, resolved to escape. A furious storm, however, prevented the passage of his troops across the York River, and on Oct. 19 he surrendered his army of about 7,000 men.

In the CIVIL WAR, Yorktown was besieged by Union forces under Gen. McClellan in Apr. 1862. The position was held by the Confederates chiefly for strategic reasons, and was evacuated in May, when McClellan was ready to take the town.

YORKVILLE, a district of New York City, centering between 83rd and 89th streets and including the area between Fifth Avenue and the East River. Roughly it extends from 59th Street to 100th Street. In former days Yorkville was a farming village, and in modern New York is inhabited chiefly by German-Americans. The most interesting landmark of this portion of the city is the Jeremiah Towle house, near the Queensborough Bridge.

YOSEMITE NATIONAL PARK, one of the most magnificent scenic regions in America, lies immediately west of the crest of the Sierra Nevada Mountains in east central California, about 160 mi. east of San Francisco. It was established by an act of Congress, Oct. 1, 1890. The boundaries have been changed several times. On Apr. 14, 1930, the date of the last revision, the park had an area of 1,150.85 sq. mi. The valley of the Yosemite itself, which comprises but 8 sq. mi. of the area of the park, was discovered in 1851 by a group of mounted volunteers pursuing Indians.

Topography and Climate. From the 13,000 foot snow-capped peaks near the eastern boundary, the general elevation of the park slopes gradually to the deep valleys on the west which are less than 4,000 ft. above sea level. The entire region is mountainous and is characterized by innumerable canyons and gorges with rushing streams, waterfalls and cascades. There are also extensive forests of giant evergreen trees, delightful mountain meadow areas and many beautiful lakes. The summers are warm but the nights are cold and clear. Yosemite is one of the favorite western vacation grounds. Rain seldom falls between May and October, making it an ideal camping ground.

Scenic Features. Yosemite, like Yellowstone, presents a vast succession of scenic wonders. Outstanding among these are the Yosemite Valley, the Grand Canyon of the Tuolumne, and the celebrated Mariposa Grove of "big trees."

The magnificent Yosemite Valley is approximately 7 mi. long and has an average width of about 1 mi. It is guarded on either side by tremendous cliffs and lofty granite domes, chief of which are El Capitan, 3,604 ft. above a pier near the Sentinel Hotel in the valley; Half Dome, 4,892 ft.; Clouds Rest, 5,964 ft.; Glacier Point, 3,254 ft.; and Sentinel Dome, 4,157 ft. Investigations by the United States Geological Survey indicate that before the Ice Age began the valley was cut by the Merced River, aided by successive uplifts of the Sierra Nevada range, to a depth of 2,000 ft. The glaciers then added about 1,000 ft. in depth, greatly widened the chasm and caused the remarkable verticality of its walls.

At the extreme southwestern boundary of the park towers Mt. Lyell, elevation 13,190 ft., a rugged glacier-crowned peak, the highest mountain of the Sierra Nevada in this vicinity. Just to the north is McClure Mountain and on the south is Rodgers Peak. This great mountain mass may be reached by trail from Tuolumne Meadows.

The perpendicular walls of the Yosemite Valley have formed some of the most remarkable waterfalls known. Yosemite Falls, for example, descends 1,430 ft. in one sheer drop, a distance nine times that of Niagara Falls. And immediately below it, the Lower Yosemite Falls drops 320 ft. or two Niagaras more. Vernal Falls has the same height, 320 ft., while Illilouette Falls is 50 ft. higher. The Nevada Falls has a sheer drop of 594 ft.; the widely celebrated Bridal Veil Falls, 620 ft. The highest falls in the park, the Ribbon Falls, has a drop of 1,612 ft. The greatest volume of water pours over the falls during the months of May and June while the winter snows are melting. In late August, however, when the water is greatly reduced, the Upper Yosemite when it reaches the ground is mostly a cloud of mist.

With the opening of roads and trails the Tuolumne Valley has become celebrated. Waterwheel Falls throws enormous arcs of water from 20 to 50 ft. into the air. Below the falls the river plunges into the mile deep gorge of the Grand Canyon of the Tuolumne which includes also the Muir Gorge, the Pate Valley and merges into the Hetch Hetchy Valley. On the walls of Pate Valley are hundreds of Indian pictographs. Hollowed out of the top of a huge rock at the foot of these walls are many bowl-shaped holes which were once an ancient Indian gristmill. Pestles, spear points, and arrowheads have been found here. A 300 ft. dam has converted the Hetch Hetchy Valley into a lake which supplies drinking water and power for the city of San Francisco. Tuolumne Meadows above the Waterwheel Falls has become a favorite camping ground in the High Sierras.

The Mariposa Grove of giant sequoias at the extreme south of Yosemite Park is second only to the

grove in SEQUOIA NATIONAL PARK. It contains the third largest tree in the world, the Grizzly Giant, whose girth is 93 ft., diameter 29.6 ft. and height 204 ft. The General Sherman Tree in Sequoia National Park is the largest and oldest tree known. Other renowned trees in Mariposa Grove are the Washington Tree with a diameter but three inches less than the Grizzly Giant; the Columbia Tree, 294 ft. in height and the Wawona Tree which has an automobile road 26 ft. wide cut through its trunk. There are also two lesser sequoia groves in Yosemite, the Merced and the Tuolumne.

Travel Routes and Facilities. The main route to Yosemite Valley from all California points, both north and south, is through Merced on the Pacific Highway through the San Joaquin Valley (Route 99). From Merced there is a splendid All-Year Highway through El Portal into the park and to Yosemite Valley. There are two other roads leading into Yosemite Valley, the Wawona Road which is reached from Fresno, Madera, or Merced and points south and west of the park and the Big Oak Flat Road from the north. The Tioga Road crosses the center of the park from east to west and connects with the Big Oak Flat Road. Merced on the Southern Pacific and Sante Fé Systems is the railroad terminal for Yosemite National Park. From here visitors may take the Yosemite Valley railroad or auto stages to the park.

There are 160 mi. of automobile roads within the park, 630 mi. of horseback and hiking trails, and many more in the process of construction. Hotels, lodges, camps, camping grounds, stores and all possible conveniences for visitors are maintained in the park under the administration of the National Park Service. The park is open the year round.

Educational Features. The headquarters museum in Yosemite, which also serves as educational center throughout the year contains a geology room, a room with rare publications, historic photographs, old hotel registers and other interesting material and a nature library comprising more than 3000 volumes. A replica of an early Indian camp has been constructed in the open space back of the museum where an Indian woman demonstrates blanket weaving, preparation of foods and other significant phases of aboriginal Indian life. A group of local Indians give periodic presentations of their native dances, games and tribal songs. In the Mariposa Grove of Big Trees, a reproduction of an old log cabin which formerly occupied the site contains, among other educational exhibits, a relief map of California showing the position of every important grove of Giant Sequoias. Telescopes at Glacier Point command views of the valley and enable visitors to study the water falls and granite formations of the region. On Sentinel Dome is another station established solely for the study of granite. Ranger naturalists are in attendance to answer questions. The Yosemite school of Field Natural History founded in 1925 meets for 7 weeks during the summer and gives training for ranger natural-

ists that is not available in the universities. Two years of college training or its equivalent are required for entrance. Graduates of this school are filling an increasing percentage of naturalist positions in the National Park Service. The Junior Nature School in which the children are divided into groups according to ages and grades meets daily for six weeks during the summer for study of wild life. Lectures are given at stated times by the park naturalists who also guide field trips and escort automobile caravans. Self-guiding nature trails have labels indicating glacial polish and striae as well as other points of geologic and biologic interest. A booklet entitled "Nature Notes" is printed monthly and, in addition to distribution within the park, is sent to hundreds of schools as also to individuals who have requested it.

YOSHIHITO, HARUNOMIA (1879-1926), Emperor of Japan, was born Aug. 31, 1879, becoming emperor in 1912. He was educated at the Peers School and by private tutors. Due to ill health, he relinquished active participation in governmental work in 1921, his son Hirohito becoming prince regent. Yoshihito's reign was characterized by more democratic relations between the ruling family and the people. He died at Hayama Dec. 25, 1926.

YOSHIZAWA, KENKICHI (1874-), Japanese statesman, born in Niigata-ken. He graduated from the Toyko Imperial University in 1899 and entered the diplomatic service. He served in various posts, many of them in China and Chosen, and was director of the Asiatic bureau of the foreign office, 1919-23, and Minister to China, 1923-29. He was appointed Minister to France in 1930 and served as Japan's representative on the Council of the League of Nations. In December 1931 he was recalled to become Foreign Minister in the cabinet of his father-in-law, Ki Inukai.

YOST, FIELDING HARRIS (1871-), American athletic director and football coach, was born at Fairview, W.Va., Apr. 30, 1871. He graduated from the University of West Virginia in 1897, and was engaged in promoting utilities and in banking until 1921, when he was appointed director of intercollegiate athletics at the University of Michigan. Also in 1921 he was appointed director of the course in physical training at the summer school for athletic coaching and administration. At Ann Arbor he produced several unbeaten teams in the Western Conference, winning the championship in 1926, and sharing it in 1923, 1924, 1925, 1927, and 1930. Yost has written extensively on children's play and home exercise for adults. Yost Field House on Ferry Field, University of Michigan, is named in his honor.

YOUNG, BRIGHAM (1801-77), Mormon leader and second president of the Church of Jesus Christ of Latter Day Saints, was born at Whitingham, Vt., June 1, 1801. In early life he was a carpenter, glazier and painter, but after conversion to Mormonism in 1832, he became a preacher and church elder. When 39 years of age, he was sent as an apostle to England, where he established missions and organized Mormon emigration. When JOSEPH SMITH, the founder

of Mormonism, was killed by a mob at Carthage, Ill., in 1844, Young was chosen his successor. Because of the growing hostility to Mormons, Young organized a migration of these people to Utah, where he chose the site of SALT LAKE CITY in 1847 and organized a flourishing colony. In 1850 President Fillmore appointed him governor of the newly organized Utah Territory. In 1852 Young proclaimed the doctrine of celestial and plural marriages, in accordance with Smith's "revelation" of 1843 at Nauvoo, Ill., and the resulting conflict caused President Buchanan to remove him from the governorship in 1858. In 1871 he was indicted for polygamy but not convicted. He was the founder of Deseret University in Salt Lake City and of the Brigham Young Academy, at Provo. The Zion Co-operative Mercantile Institution and the installation of agricultural irrigation systems owe much to him. Young died at Salt Lake City, Aug. 29, 1877. He had amassed a fortune and left 19 wives and 57 children. See LATTER DAY SAINTS.

YOUNG, CHARLES AUGUSTUS (1834-1908), American astro-physicist was born at Hanover, N.H., Dec. 15, 1834. In 1877 he became professor of astronomy at Princeton University and began a series of thorough investigations into problems of the sun. He discovered the chromosphere and the green spectral line of the corona. He wrote *The Sun*, 1881, and *Lessons in Astronomy*, posthumous complete edition 1918. He died at Princeton, N.J., Jan. 3, 1908.

YOUNG, EDWARD (1683-1765), English poet, was born at Upham, Hampshire, July 3, 1683. He was educated at Oxford, and All Souls' College made him rector of Welwyn, Hertfordshire. There, despite unremitting efforts to obtain preferment, he remained the rest of his life. He wrote three plays, and of these *Revenge*, produced in 1721, has shown the greatest vitality. His highest achievement, *Night Thoughts on Life, Death, and Immortality*, was apparently suggested by the death of his wife, daughter of the Earl of Litchfield. This famous work appeared in 1742-45. From it are taken several well-known proverbs, including "Procrastination is the thief of time." Among other writings are the satires, *The Love of Fame*. Young died at Welwyn, Apr. 12, 1765.

YOUNG, ELLA FLAGG (1845-1918), American educator, was born at Buffalo, N.Y., Jan. 15, 1845. She graduated from the University of Chicago (Ph.D.) in 1900. From the time she was 17 she was actively engaged in educational work. She began teaching in Chicago in 1862, and a few years later was the first head of the practice school for teachers. In 1869 she married William Young. From 1876-77 she was principal of an elementary school. Continually studying the newest and best educational methods, Mrs. Young was able to introduce many of these in the Chicago schools when she was district superintendent, 1887-99, and to an even greater extent when superintendent of schools, 1909-15. She was professor of education in the University of Chicago 1899-1904 and principal of the Chicago Normal School 1905-09. In 1910, she was elected president of the National

Education Association, the first woman to hold that office. Mrs. Young died at Washington, D.C., Oct. 26, 1918.

YOUNG, MAHONRI MACKINTOSH (1877-), American sculptor, painter and etcher, born at Salt Lake City, Utah, Aug. 9, 1877. He studied at the Art Students League, New York and in the Julien, Colarossi and Delaclone academies, Paris. His works include *Man with Pick*, *Stevedore* and etchings, Metropolitan Museum, New York; Hopi, Navajo and Apache groups, American Museum of Natural History, New York; bronzes and etchings, Newark Museum; etchings, New York Public Library; *Sea Gull Monument*, Salt Lake City; and painting and sculpture, Art Institute, Utah.

YOUNG, OWEN D. (1874-), American lawyer and economist, was born at Van Hornesville, N.Y., Oct. 27, 1874. He attended St. Lawrence University, Canton, N.Y., graduating in 1894, and the law school of Boston University, and began practice in 1896. After practicing in Boston until 1913, as a member of the firm, Tyler & Young, he moved to New York City, where he became counsel to the General Electric Co. His knowledge of the problems and operations of public utilities resulted in his election as a vice-president of the General Electric Co., of which he was appointed chairman of the board in 1922. Young organized the Radio Corporation of America, serving as chairman until 1929. He was co-author of the DAWES PLAN, temporary Agent-General for Reparations in 1924, and the same year acted as unofficial adviser to the London Conference of Premiers. In 1925-28 he was chairman of the American section, International Chamber of Commerce, and in 1928 was honorary economic adviser to the Chinese Nationalist Government, and a member of the Committee on Recent Economic Changes. The following year he was appointed member of the second committee of experts on reparations. He was co-author of a widely discussed plan of unemployment insurance in 1931. See also YOUNG PLAN.

YOUNG EUROPE, one of several societies like YOUNG ITALY, YOUNG GERMANY, Young Hungary, YOUNG IRELAND and Young Switzerland organized in the first half of the 19th century for the liberation of peoples oppressed by autocratic governments. The inspiration for the movement came largely from Mazzini who in 1831 organized Young Italy, which served as a model for the others.

It was an age of much idealism and faith in the inherent goodness of man. The appeal of Young Europe, like that of the other organizations of the kind, was to the youth of Europe, encouraging them to rise in revolution, abolish the existing governments, and establish republics on the basis of "Liberty, Equality and Humanity."

YOUNG GERMANY. The Young Germany of accepted tradition refers to the literary movement directed by young German writers for the furtherance of reforms in political, social and economic questions. Its originator was Ludwig Wienbarg, who prefixed

to a volume of published lectures, 1834, the following dedication: "To the young Germany, not the old, I dedicate this book." The only novelty in the vague program for the new literature that Wienbarg proposed was the theory that prose rather than the current poetry of Romanticism was the literary form of the age. HEINRICH HEINE and Karl Ludwig Borne had already voiced many of the ideals to which the young authors of the decade of the 1830's devoted themselves, and it is undeniable that the historic antecedent of the movement was the July Revolution of 1830 in France. The group of young authors associated with the Young Germany movement wrote of spiritual emancipation, which meant in practice aloofness to Christianity and faith in a vague pantheism. They proclaimed a new Hellenism founded on a harmonious union of sensuality and spirituality, which in practice resolved itself into advocating more freedom in the relations of the sexes. They talked of the rights of youth, of the emancipation of women, and of political liberty. They tried to make literature the expression of the spirit of the age, to which they did homage in journalism and fiction and in critical and argumentative essays. Yet the leaders, Heine, Heinrich Laube, Theodor Mundt and Gutzkow, had no profound sympathy with each other and each went his own way.

Though the movement was severely attacked and ultimately suppressed by the Government of the German Confederation it prepared the way for the Revolution of 1848 by making the Germans politically minded, and stimulating them to believe that even in Germany their dreams of liberty could be realized.

L. G.

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YOUNGHUSBAND, SIR FRANCIS EDWARD (1863-), British officer, traveler and writer, was born at Murree, India, May 31, 1863, the 2nd son of Major-General John William Younghusband. He was educated at Clifton and Sandhurst and in 1882 joined the First Dragoon Guards. He was detached to the Indian political department in 1890 and in 1895 he served as special correspondent for the London *Times* on the Chitral expedition. He was British commissioner to Tibet in an effort to consolidate British interests from 1902 until the consummation of a treaty, Sept. 7, 1904. He served as Bede Lecturer at Cambridge, 1905-06. He was made KCIE in 1904, KCSI in 1917 and became President of the Royal Geographic Society in 1919. During his stay in Tibet his study of that country added valuable information to our geographical knowledge of it.

YOUNG IRELAND MOVEMENT. When DANIEL O'CONNELL died in 1847 the younger element, stressing physical force rather than moral suasion, captured the movement for Irish freedom. The great revolutionary activity on the continent, which was especially successful in France, Feb. 24, 1848, com-

bined with the dire suffering of the Irish because of the potato blight, gave impetus to this departure from Constitutional methods. John Mitchel and Gavan Duffey, the literary exponents of freedom by force, soon won over Smith O'Brien and Thomas Francis Meagher to their cause. In their newspaper *The United Irishman* and in mass meetings fiery attacks upon Britain were made. Parliament resorted to coercive measures and under the Treason Felony Bill, Apr. 22, 1848, the four leaders were brought to trial. Mitchel, found guilty of treasonable utterances, was sentenced to 14 years exile (May); but the juries disagreed as to the culpability of the others.

The protest of a great meeting on July 16 was answered by decrees putting Dublin, Cork and Waterford under martial law. The radicals in preparation for a test of strength created a Council of War, and Parliament on July 22 suspended the writ of habeas corpus. O'Brien appealed to the youth of Tipperary; but his inability to win the support of the clergy and the constabulary doomed the uprising. A minor engagement with the police took place on July 29, 1848 at Ballinacorney where the flame of rebellion flickered out. O'Brien and his colleagues were condemned to death; but, over their protests, sentence was commuted to transportation to Van Dieman's Land. After the fiasco of '48 the Irish again turned to Constitutional methods of reform as expressed in the Tenant's League and the Temperance Movement of Father Mathew.

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YOUNG ITALY, *Giovina Italia*, was a secret political society established in 1831 by GIUSEPPE MAZZINI to prepare the way for the unification of Italy. The organization stood, as did its founder, for republicanism and democratic internationalism. It was hoped that the Italian people could be brought to a realization of these ideals by education, although the use of Young Italy for organizing campaigns of direct action was envisaged from the first. Coming after the decline of the *Carbonari* and before the advent of Cavourism, Young Italy played a real rôle in the Italian *risorgimento*. To it belonged the flower of Italian patriotism in the period from 1831 to 1848. After the revolutions of 1848 it was assiduously suppressed and it finally disappeared.

YOUNG MEN'S CHRISTIAN ASSOCIATION, popularly known by its initials Y.M.C.A., an organization originating in London in 1844 but now spread all over the world, whose object is primarily to provide for the religious and social needs of young men. It was founded by Sir George Williams, a London merchant who was knighted in 1894, the jubilee year of the existence of the association. The movement spread rapidly, first appearing in the United States in 1851. In 1930 the world organization numbered 10,397 separate associations having a total membership of 1,680,841. The National Council of the United States numbers 1,442 separate associations with a total membership of 1,034,019. These last figures include 314,134 boys of seventeen and under. Membership involves the acceptance of the simple

Christian tenets of the evangelical faith and the possession of a good moral character. Generous financial support has been accorded the association. The net property and funds of the world association in 1930 was \$275,833,301. In the United States alone, the net property and funds totaled \$234,064,000. The activities of the various associations have expanded so as to include the physical and educational needs of the members as well as their religious and social needs. For example, in 1930 the associations of the United States had enrolled 398,591 men and boys in their gymnasium classes. The administration of the National Council of the United States consists of 357 outstanding Christian leaders of their respective communities, of whom two-thirds are laymen. The National Council meets annually and hears reports from its four main divisions. The Domestic or Home Division provides for the needs of men and boys in large cities and in transportation centers, and special phases of its work include contacts with the Army and the Navy and among colored men. The Foreign Division does similar work among men and boys in thirty other countries. The Student Division serves the young men in colleges and universities. The Personnel Division supervises the training and placement of future Secretaries. Great Britain and Canada as well as Switzerland, Norway, Denmark and the Netherlands have especially active associations affiliated with the National Council of the United States. There are also more than 150 associations in Japan, China and Korea.

YOUNG MEN'S HEBREW ASSOCIATION, commonly known as the Y.M.H.A., a Jewish communal institution organized in many cities of the United States with the object of assisting Jewish young men to develop themselves socially, morally, physically and mentally. The parent organization was founded in 1874 in New York City and grew rapidly. Branches of the Y.M.H.A. of New York have been established in all the large cities of the United States. Especially noteworthy are those of New Orleans, La.; St. Louis, Mo.; San Francisco, Cal.; Washington, D.C., and Boston, Mass. Most of these organizations have buildings of their own which are used for educational purposes as well as offering social and physical training opportunities.

The Aguilar Free Library of New York City was originally founded by the Y.M.H.A. and was afterwards merged into the New York Public Library. Another notable organization that owes its existence to the Y.M.H.A. is the Educational Alliance of East-Side New York which was originally founded as a branch in 1891.

YOUNG PLAN, deriving its name from OWEN D. YOUNG, the chairman of the committee of independent experts who devised it, replaced the DAWES PLAN, which had been only a temporary arrangement, and attempts to settle finally the REPARATIONS question growing out of the World War. The Young Plan fixes the total number and the amount of the ANNUITIES to be paid by Germany. It specifies that the

annuities shall extend over a period of 59 years, divided into two groups: 1, those running from Sept. 1, 1929 to Mar. 31, 1966; and 2, those from Apr. 1, 1966 to Mar. 31, 1988. During the first period the annual average of the annuities amounts to about 2,150,000,000 reichsmarks and during the second period, to about 1,533,000,000 reichsmarks.

The annuities are divided into two main classes: unconditional and conditional. The unconditional part of the annuity amounts to 660,000,000 gold marks payable in foreign currencies in equal monthly installments and cannot be postponed by the German government under any circumstances. The conditional part of the annuity is subject to postponement as to transfer for a period of two years, during which time the German government is merely under obligation to pay in reichsmarks the total amount of this part of the annuity; and as to payment. One year after the German government has postponed the transfer, it has the right to postpone payment for one year of 50% of any sum the transfer of which is susceptible of postponement.

Once Germany gives notice that it intends to suspend the transfer of the conditional part of the annuity, the Bank for International Settlements is under obligation to convene a special advisory committee which is to examine all the circumstances and conditions which lead to the necessity of postponement. If this committee finds that the German government has made every effort to fulfill its obligations, it then indicates for consideration by the respective governments and the Bank for International Settlements what measures should be taken in regard to the application of the Young Plan.

The Bank for International Settlements is one of the most important provisions of the Young Plan. The purpose of this institution is to create a machinery for the payment of reparations as well as to provide additional facilities for the international movement of funds and to afford a ready instrument for promoting international financial relations. This bank has taken over all the functions of the Agent General for Reparations, whose office has been abolished. Under the Young Plan the German government makes all its payments to the Bank for International Settlements and the latter in turn pays the amounts to the various countries. All measures of foreign control imposed by the Dawes Plan on the German government, as well as all foreign representation on the Reichsbank and the German railway, have been abolished.

The annuities to be paid by Germany are derived from two sources: the German Railway Company which is under obligation to pay for 37 years a direct tax of an annual amount of 666,000,000 Reichsmarks, and the German budget. The bonds amounting to 11,000,000,000 Reichsmarks issued by the railway company as well as the industrial debentures charge imposed on German industry amounting to 5,000,000,000 Reichsmarks have been abolished, so that in 1931 with the exception of the 660,000,000 Reichsmarks

contributed by the German railway, the entire reparation payment comes out of the German budget.

In July 1932 a new reparations settlement, which ended the Young Plan and cut down Germany's final payment to \$714,000,000, was agreed to by Germany and her creditor Powers, this settlement being subject to ratification by their Governments. M. N.

YOUNG'S MODULUS. See ELASTICITY.

YOUNGSTOWN, a city in northeastern Ohio, the county seat of Mahoning Co. It is built on both sides of the Mahoning River about 60 mi. southeast of Cleveland and is served by airplanes, bus and truck lines and four railroads. The vicinity has large deposits of iron, coal and limestone, and the city has iron and steel works, rolling mills, blast furnaces, foundries and machine shops. In 1929 the factory output was worth about \$264,000,000; the wholesale trade proper amounted to \$60,889,248, retail, to \$101,516,634. The Stambaugh Auditorium is an important municipal building; many of the principal public buildings face the old public square. The Butler Art Institute and the Reuben McMillan Free Library are noteworthy. President William McKinley was born nine miles from Youngstown, and President James A. Garfield, as a young lad, frequented the town. The site was first occupied by William Hillman in 1796; the town was incorporated in 1850. Pop. 1920, 132,358; 1930, 170,002.

YOUNG TURKS, a group working to give new strength and vigor to Turkey in the 20th century. The Ottoman Empire showed unmistakable signs of weakness early in the century. Arabia, Albania and Macedonia were in a state of ferment. The public debt was increasing while foreign capitalists were gaining a stronger foothold in the country; and there were rumors of foreign intervention that might mean the partition of Turkey. The Secret Society for Union and Progress was therefore organized at Saloniki by men familiar with Western ideas, who wanted a progressive state with a strong national spirit. Having won over the Macedonian army a bloodless revolution was effected, July 23, 1908, the Constitution was restored and Abdul Hamid II had to consent to rule again by Parliamentary Government. In the first enthusiasm of success a solution of the old racial problems seemed possible; but the Young Turks soon showed leanings toward narrow-minded nationalism.

When Austria-Hungary took advantage of the situation to annex Bosnia and Herzegovina and Bulgaria declared her independence, Young Turk nationalism flared up anew. Despite this the Government recognized both actions in return for financial considerations. A fanatical counter-revolution, approved by Abdul Hamid, took place in Constantinople in Apr. 1909, whereupon a Young Turk army from Saloniki took possession of Constantinople and had the Parliament depose the Sultan and replace him by his brother, Mohammed V. In spite of many difficulties the new Government tried to bring about greater efficiency. Its attempt to Ottomanize the Empire, however, aroused the deepest discontent on

the part of subject Christians with whom the adjoining states showed a sympathy that led to the **BALKAN WARS, 1912-13**. At the outbreak of the World War in 1914, the party was divided; but the war faction soon decided that it had more to gain through joining the Central Powers. Since the war the intense nationalistic program of Kemal Pasha in the modernizing of Turkey represents in large part a renewal of the ambitions and aims of the Young Turks.

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YOUNG WOMEN'S CHRISTIAN ASSOCIATION, a world-wide movement serving the religious, social and intellectual interests of young women. The association was founded in 1855 by Miss Emma Roberts in the south of England and by Lady Kinraid in London. The Association is especially interested in young women who engage in business. For their welfare residential homes have been established, as well as club rooms, rest rooms, restaurants and similar services. The members are invited to attend classes and lectures and to participate in physical education activities. The Association in the United States had its inception in 1858 and was known at that time as the Ladies' Christian Association. In 1906 a National Board was established centralizing the administration of the many Associations in the United States and with affiliated societies throughout the world. The workers hold a biennial convention that determines the policy program and budget of the National Board. In 1929 there were 1,145 Associations in the United States, of which 691 were student Associations in colleges and universities. There were in addition 65 branches for colored girls and women and 56 international institutes and centers for foreign-born girls and women. In 1930 the total membership in the United States was 603,876. Members wear the well-known Blue Triangle as their insignia. In addition to the members there are 4,000 professional workers in the movement. Contributions and endowment funds contribute to the support of the individual Associations and the total value of their real estate in 1931 was given as \$71,749,902.

YPRES (Flemish, *Jeperen*), capital of a district in the Belgian province of West Flanders, on the Yperle River, and an important railroad junction. Of the four churches, the 13th century Gothic cathedral of St. Martin is one of the finest in Belgium. The stately Gothic halls of the Cloth Makers' Guild was built 1200-1380 with a belfry, next to which the 17th century City Hall was erected. Ypres has many schools, a picture gallery, a public library and museum. It produces lace and cotton goods and has an active trade. It is the birthplace of Cornelius Jansen, who was famous as Bishop of Ypres, 1635-38, and was founder of the Jansenists. Around the Castle Ypres, which was destroyed by the Normans and later rebuilt, the town arose gradually and in the 13th and

14th centuries was one of the most populous cities of the west. It was, however, continually involved in social conflicts and engaged in bitter feuds with the other chief cities of Flanders. It began to decline after 1383. In the 17th century Ypres was captured three times by the French and remained a French possession until 1713. After a Dutch occupation, it was again in the hands of the French, 1794-1814. It passed to the kingdom of the Netherlands, and in 1830 became Belgian. Many of the medieval buildings were destroyed in the World War, but, with the exception of the Cloth Hall, they have been entirely rebuilt since 1920. Pop. 1930, 15,187.

YPRES, BATTLE OF, the series of three major engagements along the British front in Flanders, occurring in 1914, 1915 and 1917 during the **WORLD WAR. First Battle.** The first battle of Ypres consisted of the indiscriminate fighting which occurred between Oct. 19 and Nov. 22, 1914, in the last stages of the "race to the sea." As both the Franco-British and the Germans extended their lines northward, Foch at Ypres launched a thrust independent of the larger maneuver of expansion. Its purpose was to break the German lines and roll up their front. The Germans simultaneously launched an offensive along the whole front from Menin to the sea. Heroic British resistance prevented a German break-through. On Oct. 27 the Germans renewed the attack, assaulting Ypres from the southeast. The British on Oct. 30 were forced to give way, and on Nov. 10 the Belgians evacuated Dixmude, 13 miles north of Ypres. The battle ended with Ypres in Allied hands.

Second Battle. The second action about Ypres was a German offensive launched on Apr. 22 and was aimed at reducing the British salient curving east of Ypres. It was significant for the first appearance of chlorine gas, which threw French territorial troops into a panic. Allied casualties were heavy, and at the close of the action, on May 25, the Germans had reduced the salient from a depth of 6 miles to 2½ miles.

Third Battle. The third action about Ypres was a British offensive on May 21 which continued until Nov. 4, 1917. It was inaugurated by the British capture of the Messines-Wytschaete ridge, south of Ypres. For five months the British struggled through mud and rain, exhausting their forces in a profitless advance. The main achievement was the dubious victory signified by the occupation on Nov. 4 of Passchendalle village.

YPSILANTI, a city in Washtenaw Co., southeastern Michigan, situated on the Huron River, 30 mi. southwest of Detroit. It is served by the Michigan Central Railroad and by bus lines. There is an airport. The local manufactures include paper, ladders, oil stoves, gliders, dies, automobile parts and tools. The retail trade in 1929 amounted to \$7,800,268. The Michigan State Normal College is located here. Ypsilanti was named after the Greek patriot. It was founded in 1823, chartered as a city in 1858, and received a revised charter in 1877. Pop. 1920, 7,413; 1930, 10,143.

YREKA, a town in northern California, the county seat of Siskiyou Co. It is situated 25 mi. from the Oregon boundary and 287 mi. north of Sacramento, and is served by the Yreka railroad. Gold and copper are mined in this region, and it is also agricultural, producing hay, grain and potatoes. The district affords good hunting and fishing. Pop. 1920, 1,277; 1930, 2,126.

YSAÏE, EUGÈNE (1858-1931), Belgian violinist, was born at Liège, July 16, 1858. He studied at the Liège Conservatoire without, at first, showing remarkable promise. In 1873 he studied with Wieniawski, and in 1876 Vieuxtemps, after hearing him play, obtained for him a three years' subsidy from the Belgian government. In 1886 Ysaÿe became professor of the violin at the Brussels Conservatoire. He has made many tours in the United States since his American début in 1899. Ysaÿe died at Brussels, May 12, 1931.

YTTERBIUM, a metallic chemical element belonging to the RARE EARTHS, having the chemical symbol Yb and the atomic weight 173.5. It was discovered by Urbain and von Welsbach in 1906-07. It is almost identical in properties with lutecium, and exceedingly scarce in nature. It is sometimes called neoytterbium.

YTTRIUM, a metallic chemical element very similar to the RARE EARTHS, though strictly speaking not belonging to the group. Its chemical symbol is Y, its atomic weight 88.92. Its existence has been known since 1794, but it was not definitely separated from a number of other elements with almost identical properties until 1843.

YUAN SHIH-KAI (1859-1916), Chinese military and political leader, was born in Honan province. He entered the army and went to Korea in 1882 with a Chinese detachment. Three years later he was made Chinese Imperial Resident at Seoul, and he held his post until the Chinese were ousted from Korea during the Sino-Japanese War of 1894-5. Returning to China, he rose rapidly in the government service. He was particularly active in advocating the creation of a modern Chinese army, and built up under his own command a notably well-trained and equipped army corps which came to be called the "model army." In 1898, after giving the reformers around the young Emperor the impression that he would support them, he moved his troops to Peiping and aided the Empress Dowager (*see* TZE HSI) in the coup d'état which ended the reform campaign. As Governor of Shantung in 1900, he materially aided the foreigners against the Boxers. In 1901 he succeeded Li Hung-chang in the powerful position of Viceroy of Chihli province with headquarters at Tientsin, and in this position he gave vigorous backing to the programs for railway building and industrial development in north China. In 1907 he became Grand Councillor and the most powerful man in China. After the death of the Empress Dowager in 1908, the Prince Regent, jealous of his power, sent him into retirement where he remained until the Republican outbreak of 1911 caused

the Regent to appeal to him for aid. Yuan returned to power on the understanding that he would be given full authority. The imperial authorities tried in various ways to insure his loyalty, but soon after the beginning of 1912 he began negotiations with the Republicans. These negotiations resulted in Yuan's securing the Manchu abdication on condition that he be made the first president of the republic. He assumed that office Mar. 10, 1912. Very soon he came into conflict with the Kuomintang leaders in parliament, and indicated in his actions that he had no real sympathy with republican ideas. In 1915 agitation favoring his declaring himself emperor started, secretly instigated by Yuan, it came to be believed, and at the end of the year he announced that he would assume the throne in Feb. 1916. This announcement stirred up such a storm of public protest that Yuan abandoned the plan. He died, June 12, 1916.

YUCATÁN, a state of Mexico, situated on the peninsula of the same name, with an area of about 15,939 sq. mi. Its surface is a low level plain, rising toward the center to about 200 ft. above sea level. The soil is thin, dry and calcareous, suited to the growing of desert plants except in the northeast, where it is more fertile, and produces many kinds of valuable wood, and some agricultural products. The principal product is henequen, which has made the state one of the richest commercial states in the republic. Turtles in great numbers are found along the coast, and produce the famous tortoise shell of the region. Yucatán is the home of many beautiful birds and fowls, and is noted for the *quetzal*, the Mexican Bird of Paradise. The capital is Mérida, an important port, and other towns are Valladolid, Chichen-Itza and San Antonio. Pop. 1921, 358,221; 1930, 384,790.

YUCCA, a genus of handsome plants of the lily family somewhat resembling the aloes and agaves in appearance. There are about 30 species native to the southern United States, Mexico, Central America and the West Indies, many of which are planted as ornamentals. In habit they vary from very short stemmed plants with dense basal rosettes of narrow, often bayonet-like leaves to stoutish trees with leaves clustered at the ends of the trunk or branches. The usually very numerous cup-shaped, waxy-white, commonly drooping flowers are borne in large paniced clusters that overtop the leaves. The fruit develops either into a fleshy berry or a dry, three-valved capsule. Pollination of the flowers, which open and emit their attractive fragrance at night, is effected exclusively by the YUCCA MOTH, an insect which in turn depends entirely upon the yucca for its existence. This is one of the few examples in nature of the complete interdependence and adaptation of a plant and an insect.

Of some 15 species of yucca, together with several varieties, found in the United States, nine grow to the size of trees. Among the best known are the ADAM'S-NEEDLE or bear-grass (*Y. filamentosa*), the Spanish bayonet (*Y. aloifolia*) and the Spanish dagger (*Y. gloriosa*), found along the south Atlantic and

Gulf coast, all more or less grown as ornamentals. The yuccas of the western and southwestern states include the JOSHUA TREE (*Y. brevifolia*), sometimes 60 ft. high; the southwestern Spanish bayonet (*Y. treculeana*), sometimes 30 ft. high; the southwestern Spanish dagger (*Y. Faxoniana*), often 40 ft. high, and the Mohave yucca (*Y. mohavensis*). The QUIXOTE PLANT (*Y. Whipplei*) is a characteristic component of the chaparral belt of southern California.

YUCCA HOUSE, a national monument established Dec. 19, 1919 to preserve the ruins of a prehistoric village in southwestern Colorado. The ruins are located on the gently sloping base of Sleeping Ute Mountain. They are very extensive, covering approximately 10 acres and though now but a cluster of mounds, promise to be of great archeological interest when excavated. The most prominent mound of the ancient village is known as the Upper House. It rises from 15 to 20 ft. above its foundation and dominates the adjacent smaller mounds. The stone of which the buildings are constructed is chiefly fossiliferous limestone which must have been transported by the Indians from the base of MESA VERDE over a mile away. The monument is situated a little off a well-traveled road between Shiprock, N.M. and Cortez, Colo. It is about 35 mi. north of Shiprock which is on the National Park-to-Park Highway.

YUCCA MOTH, any one of four species of moths of the genus *Tegeticula* (or *Pronuba*). These belong to the subfamily *Prodidinæ*. *Tegeticula alba* (also known as *Pronuba yuccasella*) is the best known. It is the only insect capable of pollinating a certain species of yucca. The female moth collects a load of pollen from the yucca flowers. She then deposits an egg in the ovary of this or another yucca flower. Next she climbs to the top of the pistil and pushes her load of pollen into the stigmatic opening. Development of seeds upon which the larvæ will feed is thus insured. More seeds are fertilized than are eaten by the larvæ, hence both the yucca and the insect are benefited. Full-grown larvæ leave the yucca plant to pupate in the ground. J. R. T.

YUCHI, a tribe of North American Indians belonging to the Uchean linguistic stock originally living along the Savannah River in Georgia. They were an agricultural and hunting people, typical representatives of southeastern culture. Their lodges were made of bark or mats and occasionally had clay plastered walls. These were grouped around a square area where religious ceremonies and social gatherings were held. The Yuchi killed quantities of fish by putting a vegetable poison (tephrosia) in the water of the rivers. The husk or green corn dance was their important annual celebration.

YUGOSLAVIA, officially **Jugoslavia**, a kingdom chiefly in the Balkan Peninsula, comprising an area of 96,134 sq. mi., and extending for 1,000 mi. along the eastern shore of the Adriatic Sea. It stretches from Hungary in the north close to the Aegean in the south, occupying the most important part of the Balkan Peninsula. In the northwest corner Yugoslavia is

bounded by Italy, and Hungary and Austria form its northern frontiers. Rumania lies to the northeast and Bulgaria directly to the east. To the south Yugoslavia is shut out from the shore of the Aegean by the Greek littoral. In the southwest, at Lake Prespa, begins the Albanian boundary and continues northward to Prizren, where it turns to the west and ends at the Adriatic north of Scutari.

Originally known as the Kingdom of the Serbs, Croats and Slovenes, but later changed to the Kingdom of Yugoslavia, it was composed of seven distinct provinces. Two of these, Serbia and Montenegro, were independent states before the World War, and the other five, Bosnia-Hercegovina, Croatia-Slavonia, DALMATIA, Slovenia and the Voyvodina or Duchy were carved out from the disrupted Austro-Hungarian Empire. On Oct. 3, 1929, King Alexander mapped out these provinces, cutting across former boundaries to form nine new *banats* or divisions, by name Drava, Sava, Vrbas, Littoral, Drina, Zeta, Danube, Morava and Vardar. The names of the former provinces were abolished, but for purposes of convenience, because of their long existence, they will be used in this article.

Surface Features. The surface of the country is as diversified as its wide-spread regions. The littoral is for the most part barren and rocky, while the hinterland abounds in wood-clad hills and fertile plains and valleys. The chief mountain ranges are the Julian Alps in Slovenia, which reach to a height of nearly 10,000 ft. above sea level, and the Dinaric Alps, which divide Bosnia from Dalmatia. Along the southern edge of Bosnia-Hercegovina and northern Montenegro rise the Durmitor heights to an altitude of almost 8,500 ft. North of these hills are the low, rolling limestone hills of Hercegovina. The country here is gray and dismal and very little vegetation is seen until Mostar is reached. North of Mostar Bosnia begins and the scene is relieved by the thickly wooded mountains and verdant pasturelands of that province. Croatia and Voyvodina are more fortunate than Hercegovina in that they comprise great rolling plains rich in wheat and maize.

The principal river of Yugoslavia is the DANUBE. It descends from Hungary and traverses northeast Yugoslavia, reaching the Rumanian land less than 100 mi. east of Belgrade. From this point till the Bulgarian boundary is reached the Danube forms the frontier between Rumania and Yugoslavia. The region through which the Danube flows is known as the Danubian or Pannonian basin and is one of the most fertile in the kingdom. But the Danube is essentially considered a central European river and this leaves the Sava as the largest stream of Yugoslavia. The SAVA rises in the foothills of the Julian Alps in the extreme northwest corner of the country. Flowing diagonally through the kingdom in a southeasterly direction, it joins the Danube near Belgrade. The Sava is fed by numerous tributaries. The Drina, rising near Durmitor, courses through Bosnia and empties into the Sava near Mitrovitza. The Bosna River likewise flows into the Sava. All these are

northern rivers. The principal streams of southern Yugoslavia are the Morava, with its main tributary the Nishava, and the Vardar. The MORAVA rises near Vranja and flows directly north through old Serbia to join the Danube east of Belgrade. The NISHAVA flows into the Morava near Nish, capital of the Morava *banovina*. The VARDAR has its sources in the same region as the Morava, but it flows south instead and after passing through Skoplje, Veles and other Macedonian towns, empties into the Aegean near Salonika.

Population. Yugoslavia's population is as diverse as the territories which make up the State. Serbs, Croats and Slovenes comprise the bulk of the people, about 80%, but in Vojvodina there are some 400,000 Germans and an almost equal number of Magyars. In the Banat district dwell some 250,000 Rumanians; and in the south, along the Greek, Albanian and Bulgarian frontiers are found hundreds of thousands of Bulgarians, Albanians, Turks, Vlachs and Gypsies. The Montenegrins are Serbs. They speak the Serb tongue and use the same alphabet.

The total population of Yugoslavia in 1931 was 13,930,918. The nine *banovines*, or divisions, are nearly all named after the rivers which pass through them. Capital cities and their population in 1931 were LAIBACH, capital of Drava, 59,768; AGRAM, capital of Sava, 185,581; Banjaluka, capital of Vrbas, 22,177; SPALATO, capital of the Littoral, 43,808; SARAJEVO, capital of Drina, 78,182; Cetinje, capital of Zeta, 6,367; NOVI SAD, capital of Danube, 63,966; NISH, capital of Morava, 35,384; and USKUB, capital of Vardar, 64,807. BELGRADE, the capital of the kingdom, forms a separate administrative unit and in 1931 had 241,542 inhabitants. Other principal cities are SUBOTITSA, 100,058; Moribor, 33,149; Monastir, 32,982; Velika Beckserek, 32,838; SOMBOR, 32,256; VELIKA KIKINDA, 28,011.

Religion and Education. All religions enjoy the same rights in the Yugoslav state. Sixty per cent. of the people profess the Greek-Orthodox faith. Next in number are the Roman Catholics, comprising about 35% of the population. There are about 1,250,000 Mohammedans and 75,000 Jews. The Mohammedans, however, are Serbs, or Slavs, since in the 16th and 17th centuries they accepted the Moslem faith and are still unable to speak a word of Turkish. They are found in the provinces of Bosnia and Hercegovina and represent the westernmost outpost of Mohammedanism. Sarajevo, the capital of Bosnia and of the Drina banovine, is also the seat of the highest Moslem ecclesiastical authority in the kingdom. The Serbian, or Greek Orthodox church, is governed by the patriarch and the Holy Synod of bishops at Belgrade. Belgrade is also the seat of a Roman Catholic archbishop. All ecclesiastic officials in Yugoslavia are under the control of the Ministry of Justice, Department of Public Worship.

Elementary education is free and compulsory in Yugoslavia. In 1928 there were 760,645 pupils in the primary schools and in the same year in the secondary

schools 83,172 pupils were enrolled. Besides numerous teachers' training schools in the principal cities of the various provinces, there are commercial colleges and technical schools of all kinds. There are military and naval academies and three universities. The largest university is at Belgrade with an enrollment of nearly 7,000 students. The other two universities are located at Zagreb in Croatia and at Ljubljana in Slovenia. The total enrollment in the three universities in 1928 was 12,671, and the teaching staff was about 600. In Skoplje there is a pedagogical faculty, and in Sarajevo the government maintains a school for Moslem law students.

In Croatia, Slavonia, Dalmatia and Slovenia the Latin alphabet is mostly employed, while in old Serbia, in Bosnia-Hercegovina, Montenegro and in the Macedonian territories the Cyrillic, which is kindred to the Russian alphabets, is in use. Since the accession of King Alexander there has been a movement to dispose of the Cyrillic and adopt the Latin alphabet throughout the country. Although the alphabets are in use, it was apparent in 1932 that lingual unity was practical on a national scale.

Production and Industry. Like its neighbors, Rumania and Bulgaria, Yugoslavia is essentially an agricultural state. Eighty per cent. of the population is engaged in the cultivation of the soil and in raising live stock. The chief products are wheat, maize, barley, rye and oats. The vine is cultivated extensively in Croatia, Dalmatia, Macedonia, Serbia, Hercegovina, and tobacco is grown in southern Serbia. In 1928 the country produced nearly 3,000,000 metric tons of wheat and 2,000,000 tons of maize. Considerable quantities of plums, pears and apples and other fruits are grown in Serbia, where silk cocoons are also cultivated. The richest wheat districts are in the northern part of the state, in Vojvodina and Slavonia. Bosnia supplies the timber, principally oak, beech and pine, for which Yugoslavia is noted. In Macedonia, besides the usual wheat and maize, poppy seed is an important product; the environs of Skoplje and Shtip are particularly adapted to its cultivation.

In the raising of live stock Yugoslavia is noted for its animals, especially sheep. Old Serbia has long been known as a pig-raising country. In 1929 there were in Yugoslavia 2,662,790 pigs. In the same year the number of other animals was as follows: horses, 1,109,246; sheep, 7,722,247; goats, 1,750,600; cattle, 3,644,261.

The mineral resources of the Yugoslav kingdom are reported to be considerable, but like those of other Balkan states they are not adequately exploited. The chief mineral products are coal, iron, copper, lead and chrome. In 1929 the total coal output reached about 9,000,000 metric tons. In the same year 450,769 metric tons of iron ore were mined. Bosnia produces the largest share of the country's iron. Serbia mines copper, the total production of which in 1929 was 356,577 metric tons. Lead, chrome, antimony, cement, manganese and salt are produced in lesser quantities.

The most important industry in the Yugoslav state

is flour-milling, there being over fifty mills scattered through the provinces. Brewing, distilling, weaving and cotton spinning are also important industrial enterprises. Iron-working is carried on in the regions that formerly belonged to the Austro-Hungarian empire, Vojvodina and Slovenia. In the environs of **PIROT**, near the Bulgarian frontier, the inhabitants are engaged in carpet weaving. The carpets of this locality have become famous throughout the country. They are distinguished by unique designs and their soft wool, dyed by the peasants.

Transportation and Trade. Upon its creation into a state in 1919, Yugoslavia had no major railroad problem to face. The Paris-Constantinople line enters the country in the northwest corner and, following the course of the Sava, runs practically through the entire length of the state. It reaches the Bulgarian border at Tsaribrod. At Nish, some 100 mi. west of Bulgaria, an important line branches toward Skopje to meet the Greek railway at Gevgeli for Salonika and Athens. In Slovenia, Vojvodina and Croatia Yugoslavia inherited important railways from Austria-Hungary. Due to political reasons, and also because of the mountainous character of the region, Austria-Hungary was not anxious to build railroads in Bosnia-Herzegovina and that part of Yugoslavia suffers most from lack of railway facilities. The line beginning at Ragusa (Dubrovnik) and passing through Mostar and Sarajevo for Belgrade, and the Split-Sibenik-Zagreb railway are hardly sufficient to serve these provinces. Direct rail connections are also lacking between Belgrade and southern Bosnia-Herzegovina and Montenegro. A project for the construction of a line from Belgrade to Kotor, the Montenegrin port on the Adriatic, has been under way for some time. This will be a costly undertaking, but if completed, such a railway will be of immense strategic as well as economic value. The total length of the Yugoslav railways in 1929 was 6,276 mi. Of this all but some 1,000 mi. are owned and operated by the state. In the same year the country had 25,000 mi. of state and communal roads.

Yugoslavia has 1,000 mi. of coast line along the Adriatic. The principal ports are **SPALATO** or Split, **RAGUSA** or Dubrovnik, and **SEBENICO** or Sibenik. Of the rivers the Danube is navigable through every mile of Yugoslav territory that it traverses. The Sava, Drava, Tisa and Tamish also are for the most part navigable. In Vojvodina there are three canals which are utilized for navigation as well as for irrigation. In 1929 Yugoslavia had 153 steamers with a gross tonnage of 242,000. The largest steamship company is the **Yadranska Plovidba**, or Adriatic Navigation Company, which maintains regular passenger service along the Adriatic and touches on Greek, Albanian and Italian ports.

The foreign trade of the Yugoslav state is chiefly with Great Britain, France, Italy, Austria, Hungary, Germany and Czechoslovakia. Among the articles of import cotton and cotton goods represent the largest value. In 1928 the total import value of these com-

modities amounted to 1,538,212,000 dinars. (The value of the dinar in that year was about two cents.) Iron and iron goods, machinery, silks and woollen goods are also imported in large quantities, and wheat, eggs, cattle, pigs, timber, glass, prunes and horses and cattle constitute the chief exports. In 1928 the largest item of export was timber, which reached the figure of 1,183,968,000 dinars.

Finance. The monetary unit of the Yugoslav kingdom is the Serbian dinar, normally equivalent to one franc, or twenty cents, but during the unsettled period beginning about 1926 fluctuating in value from 50 to 55 dinars for one American dollar. The National Bank of Yugoslavia with headquarters in Belgrade and branches in the principal cities is the repository of the national treasure and issues the national currency. In 1927 there were 703 banks in the country with an aggregate capital of 1,863,000,000 dinars.

Though receiving reparations from Bulgaria and Germany for losses sustained during the World War, when all Serbia was occupied by the Bulgarian armies, Yugoslavia faced difficult economic problems after the War and has repeatedly been helped by foreign loans. Her debts, not counting her war debt to the United States, amounted to billions of dinars. France was Yugoslavia's chief creditor. French capital saved a critical situation in 1931 by promptly subscribing a loan of \$42,000,000, which had been unsuccessfully negotiated through London.

In 1927-28 the total expenditures of the state amounted to 12,821,770,208 dinars. The budget for 1930-31 was 8,534,561,553 dinars and that for 1931-32 as sanctioned by Royal Decree and published in the *Official Journal* 8,522,359,292 dinars. The 1931-32 budget was reduced by about 12,000,000 dinars, but the allotment to the Ministry of War and Marine was increased from 2,522,288,333 in 1930-31 to 2,595,906,592 dinars in 1931-32, an increase of 73,018,295 dinars; the Ministry of War and Marine swallows nearly one third of the state annual budget.

Government. Yugoslavia is a constitutional monarchy, or was from its establishment in 1921 until 1929, governed by an hereditary king. The present king is Alexander I, who succeeded his father, King Peter I, upon his death in 1921. The "Vidovdan Constitution," voted on June 28, 1921 (St. Vitus Day, from which it takes its name), provided for a single chamber, or National Assembly, called *Skupshchina*, consisting of 315 deputies. The country was then divided into 33 *oblasti*, or districts, governed by *jupans*, or prefects, appointed by the minister of the interior. But on Jan. 6, 1929 (*see HISTORY*), King Alexander abolished the "Vidovdan Constitution," dissolved the *Skupshchina* and assumed sole control of the executive and legislative power. In his task of governing the country the king is assisted by a council of ministers headed by General Pera Zhivkovitch. The members of this royal council of ministers are appointed by the king and are responsible to him alone, and thus in effect Yugoslavia's government is a dictatorship. At the same time that the constitution was abolished and

the National Assembly dissolved, the country was divided, with a view to more effective and centralized administration, into nine major divisions, or *banovines*, which have already been enumerated in a foregoing paragraph. These *banovines* are administered by *bans*, or governors, appointed by the crown and responsible to it. Juridically the country is divided in a similar fashion. There are local, communal and provincial courts, and in Belgrade and Zagreb a court of cassation. In the fall of 1931 the dictatorship was abolished and a new constitution promulgated. Elections for a two-chamber parliament were held on Nov. 8, 1931, and members of both houses convened in session on Dec. 7, 1931.

HISTORY

Yugoslavia, which came into existence as a new state in 1919 at the Paris Peace Conference, was formed by the union of Serbia, the former Austro-Hungarian provinces of Bosnia, Herzegovina, Dalmatia, Croatia and Slavonia, and the kingdom of Montenegro. The Croatian National Council proclaimed its union with Serbia on Nov. 23, 1919. The only member to vote against such a union was the Croatian peasant party leader, Stephen Raditch, who was later assassinated in Belgrade. On Dec. 1, 1919, the Montenegrin National Assembly deposed King Nicholas, and united with Yugoslavia. On June 28, 1921, a new constitution, the Vidovdare Constitution, was adopted by the constituent assembly. The Paris Peace Conference did not settle Yugoslavia's boundary with Italy, disputes between the two countries continuing unsettled until Jan., 1924. The city of Fiume on the Adriatic was the basis of the principal dispute. Although President Wilson's boundary line between Italy and Yugoslavia left Fiume to the jurisdiction of the latter, Italy would not yield the city, which GABRIELE D'ANNUNZIO seized on Sept. 12, 1919. The dispute was settled when Yugoslavia recognized Italy's annexation of the city in return for a free commercial zone about it and satisfactory railroad access to it.

Yugoslavia's history has been a chaotic one. The country has been harassed by intense political partisanship and by strife between the various nationalistic groups within it. There have been 20 cabinet crises in its 10 years of existence. In 1929 King Alexander suspended the Vidovdan Constitution and abolished the *Skupshтина*; he declared himself dictator and appointed Pera Zhivkovitch prime minister on Jan. 6. Ten days later the dictator set up a Supreme Legislative Council of 17 members to take the place of the *Skupshтина* and to assist him in government. Of the 17 councillors, 11 were Serbs. Simultaneously the country was redivided into nine *banovines* or provinces, administered by appointed *bans*. These measures were taken because the peoples of the nation could not maintain amicable political unity. During the period of the dictatorship the chief difficulty was the clamoring of the Croats, Montenegrins and Macedonians for more liberal governmental measures, under the dominance of the

Serbs. The Croats threatened secession, while the Montenegrins carried on a constant campaign of terrorism to menace the Serbian officials. But on Sept. 3, 1931, the dictatorship was proclaimed at an end, the government asserting that during the 32 months of the dictatorship the people of the state had indicated their ability to cooperate amicably in carrying out the political and economic programs of the government. At the same time a new constitution, formulated by the king and his associates, was announced, changing the name to the Kingdom of Yugoslavia instead of the Kingdom of the Serbs, Croats and Slovenes, and making Parliament a bicameral legislature.

See R. W. Seton-Watson, *The Southern Slav Question*, 1911; H. W. V. Temperley, ed., *A History of the Peace Conference of Paris*, 1920-24.

YUKON, the largest river in Alaska, and the fifth in size in North America. Formed by the junction of the Lewes and the Pelly, its length from the source of the Lewes in British Columbia, near the Pacific Ocean, to the Bering seacoast, is almost 2,300 mi. Flowing in its upper reaches through canon-like valleys, shortly after entering Alaska it debouches into a plateau tundra region, where its wide and winding channels divide and flow sluggishly, especially in the great flats near Yukon; there the islands and cut-offs give the river a width ranging between 10 and 30 mi. From Fort Gibbon to Norton Sound the river valley grows steadily wider, until the vast delta region is reached, about 100 mi. inland from Norton Sound. More water is carried by the Yukon into Bering Sea than by the Mississippi into the Gulf of Mexico. The delta, which begins near 63° N. lat., is 30 mi. wide, and because of the dirt and sand swept into it ocean vessels cannot approach nearer than 35 or 40 mi. from the mouth. The river is not wooded for the first 225 mi. of its upward course. Beyond, and as far up as the mouth of the Tanana, spruce grows in abundance. The trees are from one to two ft. thick and from 40 to 50 ft. high. Cottonwood is also plentiful but is valueless commercially.

Navigation of the Yukon is divided into two sharply separated systems, the Canadian and the American, with Dawson, Yukon Territory, as the line of demarcation. The customs and navigation laws practically necessitate the transshipment of everything in and out of Alaska via the upper Yukon, at Dawson; and every boat coming into the Alaskan Yukon must stop for custom's examination at Eagle, about 100 mi. below Dawson. In summer, approximately 3,500 mi. of navigable waters are found within the basin of the Yukon, and in winter the frozen surface affords a route for dog teams. At Fort Gibbon, at the junction of the Yukon and Tanana, the two rivers usually are open by May 13 and closed by the first of November.

The most important affluent of the Yukon, within Alaska is the Porcupine, which joins it at Fort Yukon, just north of the Arctic Circle. From the standpoint of volume of water, length of course and commercial

availability, the Tanana is far the most important tributary. The Koyukuk enters the Yukon about 600 mi. from the delta, and is navigable for approximately 550 mi. The delta of the Yukon presents an admirable example of the change in coastline produced by the sediment of a great river. The extension of the stream and deposition of silt by its distributaries have added about 1,000 sq. mi. to the land area of the continent.

YUKON TERRITORY, the most westerly of the northern territories of Canada extending in triangular formation from northern British Columbia to the Arctic, between the frontiers of Alaska and the watershed of the Mackenzie River. Area, 207,076 sq. mi.

Yukon is an extension of the Rocky Mountains, but the ranges are less distinct. There are wide flats in the river valleys where hardy crops of grain and vegetables can be raised. The St. Elias range in the southwest has several great heights, including Mount Logan, 19,850 ft., the highest mountain peak in Canada. Except in the northern tundra the lowlands are wooded, in parts covered only by poor scrub. Nearly all the rivers are tributaries of the Yukon, which is navigable by river steamers from Teslin Lake, one of its sources, to Bering Sea, a distance of 2,400 mi. The Liard River drains the southern portion of the territory into the Mackenzie. The Yukon winters are long and dry; in some districts the soil is frost-bound throughout the year. Summer days are long and warm. The amount of snow and rain is not large owing to the mountains to the west; the perpetual snow line is about 4,000 ft. above sea level; the annual precipitation averages 12.8 in.

Yukon Territory is essentially a somewhat inaccessible mining country. It contains the gold districts of Klondike and Kluane. Immense fortunes have been made and lost in the Klondike. The gold production of Yukon reached its highest point in 1900 when 1,350,057 fine ounces of gold were obtained. This output has gradually decreased. In 1912, 268,447 ounces were produced; in 1920, 72,778 ounces; and in 1928, 34,364 ounces. The Mayo and the Keno Hill districts are the chief sources of silver production. A concentrating plant which eliminates much waste was erected in 1925 at Keno Hill, and this has reduced the high cost of transporting ores. In 1928 the silver obtained from the Yukon was valued at \$1,651,985. There are about 5,000,000,000 tons of coal in the territory, but owing to difficulty in mining and little demand for coal the local needs of light, power and heat have been met by the native timber resources, water power and imported oil.

The rivers and lakes are well stocked with whitefish, salmon, Arctic grayling, pike, pickerel and maskinonge. Trapping is a lucrative industry and the fur-farming industry is expanding. White fox, lynx, beaver, otter, muskrat, weasel, mink, marten, coyote, wolf and bear roam the territory. The principal trees are spruce, poplar, balsam fir, pine and birch.

Dawson City, the capital of the territory, is now

linked by rail with Bonanza, by boat with the outer world during the navigation season, and there are aviation grounds. Whitehorse is the center of the copper mining industry. Mayo has a public school and a hospital.

The number of inhabitants fluctuates. With the decline of the gold mining industry the population decreased from 27,219 in 1901 to 4,157 in 1921; in 1929 there were about 5,000 Eskimos, Indians and white people. The territory is administered by the Northwest Territories branch of the Canadian Department of the Interior. The Royal Canadian Mounted Police enforce law and order. Pop. 1921, 4,157; 1931, 4,230.

YUMA, a town in southwestern Arizona, the county seat of Yuma Co. It is situated on the Colorado River at the mouth of the Gila River, 180 mi. southwest of Phoenix. The Southern Pacific and Yuma Valley railroads serve the town. There is a municipal airport. Lead, copper and silver are mined in the vicinity. This region is extensively irrigated, being a part of the United States Arizona-California reclamation project. Dairying, poultry-raising, pecan, citrus and truck farming are the leading agricultural interests. The town is a trading and transportation center. The chief manufacture is a water softener. Pop. 1920, 4,237; 1930, 4,892.

YUMAN, an important linguistic family formerly occupying an extensive territory which included much of the valley of the Colorado River, the lower valley of the Gila River, northern Lower California and all of extreme southern California. They varied widely in cultural development. The tribes of the barren region of Lower California possessed a crude society while those of the more favorable Colorado valley were comparatively advanced. The Colorado River tribes had excellent physiques, lived in settled villages with well-defined tribal lines and were expert makers of basketry and pottery. They practiced a rude but adequate form of agriculture, raising the principal Indian staples with the exception of tobacco which they preferred in its wild state. Boats were unknown to them and in crossing rivers they used crude rafts or balsas made of bundles of reeds or twigs. Clothing was sketchy. The men frequently did not wear breech-cloths and the women wore only a short petticoat made of strips of bark. Face and body of both men and women were painted with black, red and other colors. Important Yuman tribes are the Cocopa, Diegueno, Maricopa, Havasupai, Mohave, Tonto, Walapai, Yavapai and Yuma. They have now been gathered into reservations.

YUOK, a tribe of North American Indians formerly living along the lower Klamath River and the adjacent coast in northwest California, and constituting the Weitspekan linguistic family. They were taller than the average California Indian and it is probable that they had some Athapascan blood. Whites were unknown to them before 1850. With the exception of a few mixed-bloods they are now extinct.

Z

ZAANDAM or **SAARDAM**, a town in the Dutch province of North Holland, 4 mi. northwest of AMSTERDAM. The city is divided into two parts by the River Zaan and so transected by canals that many houses with their gardens form little islands. It produces paper, paint, starch, tobacco, cacao, zwieback and glue and engages in shipbuilding and fishing. A few of the famous docks of the 17th century remain. In 1697 Peter the Great worked here as a ship carpenter. His house to-day is still intact. Several of its painted frame houses, for which Zaandam was famous in former times, remain standing. Pop. 1930, 33,121.

ZACAPA, capital of the department of Zacapa, GUATEMALA, 55 mi. from the boundary line with Salvador and near the River Motagua. There are no large towns along the line of the Guatemala Northern Railway; Zacapa is the largest and contains the railroad shops and offices. From this town was recently built a branch line to SALVADOR, the only Central American republic with no Atlantic seaport, which gave that republic an opening to the Gulf of Mexico and United States ports. Pop. 1928, 18,094.

ZACATECAS, a state of Mexico, situated in the central part of the republic, on the great central plateau, with an area of 24,471 sq. mi., and an elevation of about 7,500 ft. It is one of the most mountainous states in the republic, and is traversed on the west by the Sierra Madre Occidental Mountains, and in other parts by lesser ranges. Deep gulches and sharp declivities make up almost the entire surface of the state. It has a dry, cold climate, calcareous unproductive soil and only a few rivers. Zacatecas is the native home of the *guayule*, or rubber plant, which has become of great commercial value in the United States. The chief industry is mining, and some of the oldest and richest silver mines in the world are located here. The capital is Zacatecas, and other towns are Sombrerete and Fresnillo. Pop. 1921, 379,329; 1930, 465,021.

ZACATECAS, a city of Mexico, and capital of the state of the same name, situated about 439 mi. northwest of Mexico City, at an elevation of 8,010 ft. above sea level. The city is in the center of a silver-producing region. It lies on the side of the Grillo and Bufa mountains, its steep and narrow streets winding upward among quaint flat-roofed buildings, give the city the appearance of a fortress. The houses are strongly built, many of them several stories high. There are some cotton and woolen mills, a sugar refinery and an old market. The cathedral is constructed of beautifully carved red sandstone, topped by a tower and tiled dome. A chapel, to which distant pilgrimages are made, stands on the Bufa Hill, and is one of the noted old landmarks of Mexico.

Zacatecas was founded in 1548, and was made a city in 1585. Pop. 1921, 15,462; 1930, 21,188.

ZACHARY, ST. (?-752) a Greek by birth, became Pope in 741, succeeding Gregory III. He started the Vatican Library and translated Gregory's dialogues into Greek. He sustained Pepin the Short in his claim to the French throne. Through his influence with the Lombards, especially King Luitprand, he obtained many advantages for the papacy. At his intervention Ravenna was kept from becoming part of the Lombard kingdom. His correspondence with Boniface shows his influence in Germany also. He disapproved of Constantine's stand in the iconoclastic controversy. The fate of captives brought to Rome was a matter of great concern with him, and he often redeemed them. He died in 752.

ZAGREB. See AGRAM.

ZAHAROFF, SIR BASIL (1850-), financier and philanthropist, was born at Constantinople, Oct. 6, 1850. He was educated at London and Paris, and later became interested in manufacturing companies. During the World War, and after, he was consulted on various matters by Lloyd George, Briand, Clemenceau and other political leaders in England, France and other countries. He has been active in many charities and relief associations particularly in Greece, besides establish a Chair of Aviation at the University of Paris, the Marshal Foch Professorship of French Literature at Oxford University, and the Field Marshal Haig Chair of Literature at the University of Paris.

ZAHMENDORF, LAZARUS (1859-1917), inventor of ESPERANTO, was born Dec. 1859, at Bialystok, Poland. The name "Esperanto" derives from his signature to the communications on the subject of an international language. His ideas seemed reasonable to many and attracted much interest as they demonstrated the possibilities of a universal idiom. In 1910 an Esperanto Congress was held in the United States, which Zahmendorf attended. He was by profession an eye specialist, practising at Warsaw, where he died April 14, 1917.

ZAMA, an ancient city of Africa west of Carthage, noted in history for the battle which brought to an end the Second Punic War (see PUNIC WARS), the decisive part of the struggle between Rome and Carthage for supremacy. It was here in 202 B.C. that Hannibal, the great Carthaginian general and one of the greatest military strategists of all time, was defeated by the Roman forces under the command of P. Cornelius Scipio the Elder, later known as Africanus. Scipio was determined to carry the struggle into Carthaginian territory in Africa and for this purpose had invaded African soil the previous year. The Carthaginians were about to accept a truce; but upon

the return of Hannibal, sentiment soon changed, and they rallied to his support. The Romans expected reinforcements from Masinissa, who was to receive his Numidian kingdom in return for aid. Scipio thus planned to meet the Carthaginians not far from the Numidian border so that Masinissa's troops could easily arrive. The Carthaginians used elephants for the first line of battle; but instead of putting the Romans to rout, the elephants were misled and the Romans soon put the Carthaginians to rout. Although the Carthaginians outnumbered the Romans, the former having 50,000 men as against the latter's 36,000, the Romans gained a decisive victory. For the first time Hannibal met defeat in a pitched battle, and Zama marks the end of Carthaginian power.

There were other cities by the name of Zama, the locations of which are not known.

ZAMBEZI, the fourth largest river in Africa, and the longest of those flowing into the Indian Ocean. It is about 2,200 mi. long and drains more than 500,000 sq. mi.

Rising in the marshy country on the southeast borders of Katanga, Belgian Congo, and flowing generally east and west, it enters the sea by a number of shallow mouths almost midway between the two ports of Beira and Quelimane. Owing to the nature of the country through which it passes, it is mainly a broad, shallow and slow-moving stream, but where it pierces the hills or drops from the high plateau it becomes an unnavigable torrent rushing through deep gorges. Flowing southeast across the Barotse Plateau to the Victoria Falls, it drops 357 ft. into a huge canyon at right angles to the river which is on the line of a volcanic area stretching from the Vaal river to about 60 mi. beyond the falls. On each side of the Victoria Falls the general level of the land is the same; it is believed that at some early period the Zambezi suddenly changed its course owing to seismic action, and instead of running south to the Orange River plunged into the volcanic fissure, and after being forced to run in four contrary directions finally emerged in an easterly course and spread over the Rhodesian plains.

Save for one short barrier of rapids, the Zambezi is navigable from near its source to the neighborhood of the Victoria Falls, a distance of about 600 miles. Below the Molele Rapids, 150 mi. from the waterfall, the river again broadens out and is navigable for about 850 miles, as far as the Kebrabasa Rapids, with the exception of two short stretches: the Kariba or Livingstone Gorge, about 20 mi. long, and the Kanasala Rapids. The Kebrabasa Rapids, with a length of 75 miles, are about 30 mi. above Tete, and constitute an impassable barrier to navigation. But below this point the river is navigable as far as the sea, though boats proceed with difficulty through the narrow Lupata Gorge.

During its long course the Zambezi receives numerous tributaries, many of which rise from the Angola plateau and flow into the river above Victoria Falls, forming a stream 3,000 ft. broad at the falls; other tributaries drain chiefly from the north and enter the

Zambezi on its left bank. Among these last the principal streams are the Kafue, a broad sluggish river available for navigation where it is not blocked by rapids; the Luangwa, bounded on the west by a steep escarpment and on the east by the Fort Jameson Plateau; and the Shire, which flows out of Lake Nyasa. In the extreme west of Rhodesia, the Kwando or Chobe River joins the Zambezi above Victoria Falls.

DAVID LIVINGSTONE explored and descended the Zambezi to its mouth about the year 1855.

ZAMORA, NICETO ALCALA (1877-), first President of the Spanish Republic, born at Priego de Cordoba, July 6, 1877, the son of an established, land-owning family. He was educated at the universities of Granada and Madrid, became a legal writer, and entered politics as member of the Cortes from La Carolina, Jaen Province, in 1906, holding this seat until 1923. In 1907 he was likewise Secretary to the Civil Governor of Madrid and in 1918 Minister of Public Works. He gradually formed a following of his own in the Cortes, which made him Secretary of War in 1923 until the Spanish defeats in Morocco. During the dictatorship of Primo de Rivera, Zamora was forced to retire to his country home. Although previously a devoted monarchist, in Dec. 1930 he became an avowed Republican and until Mar. 1931 was imprisoned. He was Republican candidate in the Madrid municipal elections, Apr. 12, 1931, which, by their unexpectedly heavy Republican majority, led Alphonso XIII to abdicate. Zamora, representing the only government left in the capital, became provisional President and after the adoption of a permanent constitution, Oct. 29, 1931, providing for a six-year presidential term, was elected by the Cortes Dec. 10 and inaugurated the next day. Although approving bills to curb the political power of the Catholic Church, Zamora is a Catholic and a moderate, and has attempted to steer the Spanish revolution away from religious, political or economic extremism.

ZANESVILLE, a city and county seat of Muskingum Co., O., on the Muskingum and Licking rivers, 58 mi. east of Columbus. It is served by the Baltimore and Ohio, the New York Central, the Pennsylvania, the Wheeling and Lake Erie railroads, and motor bus and truck lines and river boats. A unique "Y" bridge spans both rivers. Besides clay products for which Zanesville is noted, glass, marble, lumber and steel works are important. In 1929 the value of manufactures was about \$25,000,000; the retail trade amounted to \$21,048,733. The city has excellent electric power for industries furnished by a huge power plant a few miles distant.

The site of Zanesville was occupied when Zane's Trace was cut through from Wheeling in 1799. The town was planned in 1800 and incorporated in 1814. It was the state capital in 1810-12 and the city was chartered in 1850. Pop. 1920, 29,569; 1930, 36,440; 90% native white.

ZANGWILL, ISRAEL (1864-1926), Jewish author and Nationalist, was born in London, Feb. 14,

1864. He received his early education at Plymouth, at Bristol, and at the Jews' Free School at Spitalfields, where he taught for a time. He did journalistic work in London, and in 1892 published the widely-known novel, *Children of the Ghetto*. This book was followed by *Ghetto Tragedies*, *The Master*, *Dreamers of the Ghetto* and *The Mantle of Elijah*. Zangwill wrote several successful comedies and three serious plays, *The Melting Pot*, *The War God* and *The Next Religion*. *Children of the Ghetto* has also been dramatized and frequently produced. Zangwill was deeply interested in the Zionist Nationalist movement. He occupies a high place among modern Jewish writers. He died in Sussex, England, Aug. 1, 1926.

ZANTE, port and principal town of the island of Zante, also a seat of a nomarchy. It is situated on the east coast of the island, which is itself about 15 mi. off the coast of the Morea. Town and island, after being governed by Romans, Venetians and other Mediterranean powers, became the protectorate of the British, who in 1864 ceded them to the kingdom of Greece. Zante is the point of export of the currants, olives, wine, oranges, lemons and other fruits which the island produces. It is the seat of a Greek archbishop and of a Roman Catholic bishop. Pop. 1928, 11,609.

ZANZIBAR, an island separated from the east coast of Africa by a channel 22 mi. wide at its narrowest part. This alluvial and coralline island is 640 sq. mi. in extent and lies a few degrees south of the equator. With Pemba (area 380 sq. mi.) it is a British protectorate, under the nominal rule of a sultan. The estimated population of Zanzibar in 1924 was 128,099; of Pemba (which lies 30 mi. to the northeast), 88,691, consisting mainly of Swahilis, but there are also 20,000 Arabs, 12,000 Indians and about 270 Europeans. The death rate exceeds the birth rate.

These fertile tropical islands are intensively cultivated. Many kinds of fruit are grown, but the most important products are cloves and cocoanuts. The islands produce 90% of the world's supply of cloves. The industry first became important early in the 19th century, when it was encouraged by the reigning sultan. A violent cyclone destroyed most of Zanzibar's plantations in 1872, and, although most of them have been re-established, Pemba leads to-day with 40,000 acres under cloves as against 20,000 acres in Zanzibar.

The town of Zanzibar (55,750 inhabitants) is opposite the mainland; it provides an extensive and sheltered anchorage and is visited by much shipping. For several centuries it has been the principal Arab trading station on this coast and a great port for the whole of East Africa. The principal exports are cloves, copra and ivory.

In 1890 Germany and France, in a treaty with Britain, agreed to recognize the British protectorate over Zanzibar, Britain waiving all claims to Madagascar and ceding Heligoland to Germany.

ZÁPOLYA, JOHN (1487-1540), King of Hungary, was born at Szepesvar, Austria, about 1487, the son of the palatine, Stephen Zápolya. He was ap-

pointed governor of the infant Hungarian King, Louis II, in 1516. On the death of Louis in 1526, at the battle of Mohacs against the Turks, John Zápolya was elected King of Hungary in opposition to the other claimant, Ferdinand of Austria. After a long quarrel between John and Ferdinand, a treaty was drawn up in 1538 which recognized John as king, while granting concessions to Ferdinand. John died in 1540.

ZAPOROZHYE, at one time known as Alexandrovsk, an important town and railway junction in the southeastern part of the Ukrainian S.S.R. It is built south of the falls on the Dnieper River. It has water connections to Odessa, and Black Sea vessels can now come into the widened river. Zaporozhye is a leading grain export center, and motors and agricultural machinery are manufactured in considerable quantities. Pop. 1926, 55,744.

ZAPOTEC, an important Indian stock living in the states of Oaxaca and Guerrero in southern Mexico. Before the Spanish Conquest the Zapotec were a powerful nation which had successfully resisted the Aztecs. They were chiefly a sedentary agricultural people living in houses constructed of stone and mortar. Their system of mythology and religious observance was complex. Mitla and other ruins within their territory were regarded as the tombs of their ancestors. The Spaniards conquered them in 1522-26. By 1550 they had submitted peacefully to missionary influence and thereafter the Zapotec were a hard-working and stable part of the Mexican population. Their descendants now number more than



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ZAPOTECAN INCENSE BURNER OR FUNERARY URN

250,000. Benito Pablo Juárez (1806-71), the celebrated president of Mexico, was a full-blooded Zapotec Indian.

ZARA, formerly a city of Austria, since 1921 Italian, situated on a fine harbor in an isolated position on the eastern shores of the Adriatic. There are Roman remains, and broad promenades have replaced the earlier fortifications. The chief square is the Piazza dei Signori, with a fine Loggia and campanile. The principal churches are the 13th century cathedral in Lombard style, San Simeone, built in honor of the town's patron saint, and the former San Donato built in the 9th century on the site of an ancient temple, now a museum. Noteworthy are also the palace of the priors, the archiepiscopal palace and the theater. In medieval times Zara belonged to the East Roman Empire, but it became Venetian in 1200 and changed hands frequently. It fell to Austria in 1797 and, with the exception of temporary French occupation, remained so until it became Ital-

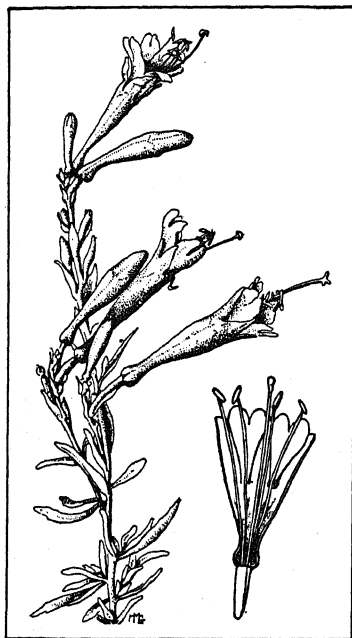
ian after the World War. The city has numerous schools and a seminary. The chief industry is the manufacture of maraschino liqueur and there are other diversified products. Pop. 1931, 18,614.

ZARAGOZA. See SARAGOSA.

ZARATE, a city of Argentina, situated about 50 mi. southwest of Buenos Aires. Besides being the trade center in the nearby agricultural district, it is the location of the country homes for many wealthy people who commute by fast train to Buenos Aires. It has fine schools and modern buildings. The agricultural products of its trade district are corn, wheat and barley. Est. pop. 1930, 23,000.

ZARATHUSTRA, the central figure in *Also Sprach Zarathustra*, "Thus Spake Zarathustra," 1885, a book embodying the philosophic ideas of F. W. NIETZSCHE, especially his conception of the Superman. Zarathustra is modeled upon the great Persian prophet, Zoroaster.

ZAUSCHNERIA (*Z. californica*), a low, slightly shrubby perennial of the evening-primrose family called also California fuchsia and Mexican balsamea. It is native chiefly to gravelly slopes in the Coast Range of California and is sparingly grown in flower



FROM JEPSON, MAN. FL. PLANTS CALIF., COPYRIGHT

MEXICAN BALSAMEA

(*Zauschneria californica*). Flowering branchlet and longitudinal section of the flower

gardens. The branching stem, about 1 ft. high, bears small, narrow, grayish-green leaves and large, brilliant scarlet, fuchsia-like flowers blooming in autumn.

ZEALAND, an island of Denmark, 11 mi. east of the island of Funen and only 3 mi. west of the southern point of Sweden. Zealand covers an area of 2,636 sq. mi. and is the largest of the Danish islands. It contains Copenhagen, the capital, Elsi-

nor, of historical importance as a port, and Roskilde, in which is located the cathedral of the primate of Denmark. The region is picturesque, with forests, grain fields and rich pasture lands. Several small lakes add to the beauty of the landscape. In the south the island is traversed by the winding Sus-Aa River. See also DENMARK.

ZEALOTS, the name of a Jewish party relentlessly opposed to the bringing of Judea under the dominion of Rome. It was the aggressive and fanatical war party from the time of Herod until the fall of Jerusalem. Its members were known also as Sicarii, because of their practice of carrying secretly daggers ("sicae"), wherewith they would stab those found guilty of committing a sacrilegious act. Originally the name of the party signified religious fanatics and it is said that the rigid rabbinical laws governing the relation of Jews to idolaters, as well as those concerning idols were originally ascribed to them. Josephus tells of one of the Zealots that he slew his wife and his seven sons rather than allow them to be slaves to the Idumean Herod (*Antiquities* 14, 15, 5; *Jewish War* 1, 16, 4). It was for the sake of punishing the crimes of idolatry and bloodshed committed by Herod that the Zealots of Jerusalem were bent upon slaying him. In their opposition to Rome the Zealots were inspired by religious motives. In a speech attributed to the Zealot leader Eleazar ben Jair it is declared that it is a glorious privilege to die for the principle that none but God is the true ruler of mankind, and that rather than yield to Rome, which is slavery, men should slay their wives and children and themselves, since their souls will live forever.

The Zealots were proud of their name, because of their religious zeal. Their right to assassinate any non-Jew who dared to enter the consecrated parts of the Temple was officially recognized. This is apparent from a statute inscribed upon the Temple wall and discovered in 1871. They were zealous for the honor and sanctity of the Law as well as of the sanctuary. But when they were so carried away by their fanatic zeal as to become wanton destroyers of life and property throughout Palestine, their acts met with disapproval. The Talmud (*Yaddaim*, 4, 8 and *Sotah* 9, 9) denounced them as heretical Galileans and murderers. The peace-loving Pharisees repudiated both their principles and their deeds.

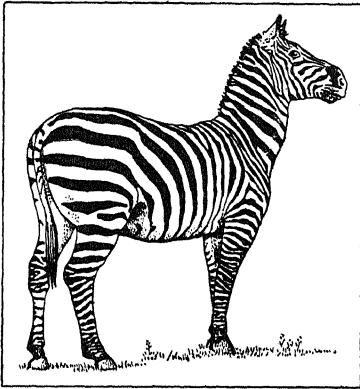
As the oppression of Judea by the Roman procurators increased, the passionate violence of the Zealots grew in intensity. At the beginning of their struggle against the Romans, the Zealots appear to have been successful in routing and annihilating whole armies of Roman soldiers, but ultimately they succumbed to the sword or to other instruments of death or torture at the hands of the Romans. It was a desperate and mad spirit of defiance which animated the Zealots and made them prefer horrible torture and death to Roman servitude.

In the New Testament (*Luke* 6, 15 and *Acts* 1, 13) mention is made of a disciple of Jesus bearing the name of Simon the Zealot.

J. BL.

ZEBRA, one of the three types of equine animals, constituting the genus *Equus* and family *Equidae*. Zebras differ from horses in being wholly African, in their striking coloration, in the absence of callosities on the hind legs, and in the lack of a long-haired mane and tale. They differ from the wild ass mainly in color and in preferring grassy plains to arid, rocky deserts.

Four types of zebras may be considered. 1. The quagga (*Equus quagga*) of South Africa, now to be



COURTESY AMER. MUS. OF NATL. HISTORY
EAST AFRICAN ZEBRA

seen only in reserves, although formerly it roamed the plains of Cape Colony in vast herds. The head and forward part of the quagga's reddish-brown body is striped a dark brown, the stripes becoming fainter behind the shoulder, and disappearing from the hind quarters and legs. Its specific name comes from its barking neigh. 2. The once common or mountain zebra (*E. zebra*), formerly very numerous in South Africa, is now rare. Its body-color is white, everywhere striped with black. 3. Burchell's zebra (*E. q. burchelli*), a form of the quagga, has the body-color yellowish-brown marked with dark stripes, very broad on the back and hips. It is large and robust, and still abounds on the central plains of Africa. 4. The northern zebra (*E. grevyi*) is still larger than Burchell's, and differs strikingly from it by being thickly marked with very narrow black stripes. E. I.

ZEBRA GRASS, an ornamental perennial (*Miscanthus sinensis* var. *zebrinus*) with broad, long leaves marked at intervals with whitish or yellowish bands. It is a native of China and Japan sparingly naturalized from cultivation in various parts of the United States. The tall, smooth, very leafy stems grow 4 to 10 ft. high bearing large, feathery, silky-tufted flowering panicles.

ZEBRA-WOLF (*Thylacinus cyanocephalus*), a predatory marsupial, native to Tasmania, called also Tasmanian wolf or thylacine. It has much the shape of a large, gaunt, long-legged hound, and the ferocity and hunting habits of a true wolf. Its short, smooth coat is tawny-gray in color, marked on the hinder parts with broad, blackish transverse bands. Zebra wolves live in dens in the mountains, but hunt alone

at night for their prey, and formerly were numerous. After Tasmania began to be colonized, they made such havoc with sheep and other domestic animals that it was necessary to kill them off, so that now few remain, except in captivity, where they live and breed well.

E. I.

ZEBU (*Bos indicus*), the common ox of India, distinguished by a curious hump at the shoulders. Its first ancestor is unknown, domestication dating from before the dawn of history. This long domestication has resulted in many variations in size, some zebus being no larger than a big dog, while the tallest exceed all other oxen in height. In color, zebus range from clear white to dirty cream color, an unusual gray-blue being sometimes seen. The white bulls are held sacred in India, but those of ordinary coloration are the most common beasts of burden. Zebus are easily handled, and some breeds can travel 30 mi. a day. Hindus will not eat zebu flesh and the fact that the Mohammedans of India do has been a common cause of friction between these two dominant religious groups.

These humped cattle are also used in China and the Asiatic islands, and have been introduced with success into South America. In the United States, zebus are called Brahman cattle, and the larger types have been imported and sparingly reared for meat and milk production. Brahman cattle are adapted to certain sections of the Southwest, notably Texas. They graze on scant pasture, resist hot weather, disease and pests, and have high breeding efficiency. The first importation was probably made in 1849, but the largest was that of 1906, when A. P. Borden of Texas imported 51 head. Preferred types are the Nellore, Gir, Guzerat and Krisna Valley breeds.

ZECHARIAH, BOOK OF, one of the minor prophetic writings of the Old Testament, derives its name from a Hebrew prophet who flourished about 520 B.C. It falls into two divisions, Chapters 1 to 8, and 9 to 14, and contains a number of wrathful pronouncements and visions against Tyre, Sidon, Damascus and Philistia, which "the angel of the Lord" communicates and interprets to the prophet. Although Jerusalem is to be "the city of truth," the book is one of the Hebrew writings which conceive of God as the God of the whole world. Many modern scholars see in both sections much internal evidence for ascribing it to a post-exilic authorship.

ZEDEKIAH, in Biblical account, the son of Josiah and the last king of Judah, appointed king by Nebuchadnezzar after the capture of Jerusalem in 597 B.C. Zedekiah began an intrigue with Egypt which aroused the wrath of the Babylonian king, and in 586 B.C. Jerusalem fell once more, this time being completely destroyed. Zedekiah himself was blinded and taken to Babylon in chains.

ZEELAND, a southwest province of The Netherlands, bounded by Belgium, the province of North Brabant, province of South Holland and the North Sea, embracing chiefly six islands, Walcheren, North and South Beveland, Tholen, Duiveland and Schou-

wen. Zeeland has an area of 708 sq. mi. The chief towns are Middelburg and Flushing on Walcheren. The surface of the islands, most of them below sea level, and protected from the sea by dikes. The soil is fertile and barley, wheat and rye are cultivated extensively. Pop. 1928, 248,592.

ZEEMAN, PIETER (1865-), Dutch physicist, was born at Zonnemaire, Zeeland, May 25, 1865. During 1890-1900 he taught physics at the University of Leyden, leaving in 1908 to become professor of physics at Amsterdam. His outstanding contribution to physics was his discovery, in 1896, of the **ZEEMAN EFFECT**, or the splitting of spectral lines in a strong magnetic field. The theoretical explanation of it was given by **HEINRICH LORENTZ** immediately after the effect had been discovered; it finds extensive application in physics and astronomy, notably in the detection of magnetic fields on the sun. Zeeman was awarded the Nobel Prize in physics in 1902.

ZEEMANN EFFECT. See **MAGNETO-OPTICS**.

ZEISS, CARL (1816-88), German optical expert, was born at Weimar, Sept. 11, 1816. In 1846 he founded his optical works at Jena and in 1866 was joined in this enterprise by Ernest Abbe. The Zeiss plant under their joint management soon obtained world recognition for the manufacture of optical instruments and glass. Zeiss died at Jena, Germany, Dec. 3, 1888.

ZEITZ, a German city in the Prussian province of Saxony, about 30 mi. southwest of Leipzig. A Slavic settlement, it became important in 968 when Otto I founded a bishopric, which was removed to Naumburg about 1029 because of attacks from the Slavs. It was the residence of the dukes of Saxe-Zeiss from 1656 to 1718. Important buildings of the city are the 12th century St. Michael's Church, the 13th and 15th century Castle Moritzburg with its church, and the 16th century town hall. The factories of Zeitz produce perambulators, pianos, soap and perfumes. Textiles, gloves and wooden goods are also manufactured. Pop. 1925, 34,590.

ZELAYA, JOSE SANTOS (1853-1919), Nicaraguan President and Dictator, 1894-1909. Though professing liberal tendencies, Zelaya maintained himself in office by the customary dictatorial procedure, until forced to resign in 1909. He followed a policy of granting monopolies for all the important industries, and shared in the profits resulting from them. In 1907 he essayed to reestablish the Central American Confederation, but failed. Zelaya's execution of two American soldiers in the revolutionary army led to a protest by the United States government, and was the beginning of American intervention in Nicaragua.

ZEMSTVO, a Russian district or provincial assembly established by an imperial ukase or decree, 1864, of Alexander II's a few years after the emancipation of the peasantry. The Zemstvos consisted of representatives of the towns, of the landed proprietors and of the villages. In a general way, they had control in the provinces over economic affairs which included

local taxes, roads, bridges, public health, hospitals, schools and other local matters.

In 1890 both the method of election and the representation were changed somewhat in order to bring the Zemstvos more directly under the control of the autocracy. The villages for example, were no longer allowed to elect their delegates, but merely to nominate candidates from among whom the governor chose the deputies. The proprietors on the other hand continued to elect their own and were accorded additional representation. In the towns the householders elected the representatives. Despite this effort to bring the Zemstvos more in line with the central Government, they continued to function fairly independently, furnishing an excellent example of how, even in Tsarist Russia, local government could operate.

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ZENANA, a Persian word derived from the root *zan*, meaning woman. The term *zanana* is used in Moslem India, in particular, to designate the women's quarters in the household. More inclusively, it denotes a Moslem's family as well as their residence. It is equivalent to the Arabic harem.

ZENGER TRIAL, 1733-34, a libel suit which resulted in an epochal decision in the legal battle for freedom of the press. John Peter Zenger, editor of the *New York Weekly Journal* (New York City; vol. 1, No. 1, Nov. 5, 1733), editorially denounced the government of the Council. Certain issues of his journal were ordered burned by the public hangman, and Zenger was imprisoned for libel. Andrew Hamilton, counsel for the defendant, maintained at the trial that since the statements published were true there was no libel. Chief Justice Morris, presiding, contended that the truth of a libel was inadmissible as evidence. The jury disregarding the ruling of the court, rendered a verdict of not guilty, a notable decision in the history of a free press.

ZENITH, the point on the celestial sphere directly above the observer.

ZENKER, FRIEDRICH ALBERT VON (1825-1898), German physician and pathological anatomist, was born in Dresden on Mar. 13, 1825. Studying medicine at Leipzig and Heidelberg, he became professor in the Academy of Medicine at Dresden in 1855, and seven years later accepted a call to Erlangen. At Dresden he discovered, in 1860, the trichina and the havoc that it causes in the human body. He received his title in 1887, left the university of Erlangen in 1895 and died at Reppertin, Mecklenburg, on June 13, 1898. See also **TRICHINOSIS**.

ZENO (c. 362-c. 264 B.C.), Greek philosopher and founder of the Stoics, was born at Citium, Cyprus, in 362 B.C. He began his career but after studying as a Cynic at other schools he established his own school. He lived abstemiously. He was orderly in appearance, unlike the Cynics, and his manner was simple and resigned. At the age of 98, he strangled himself. His writings have all been lost.

ZENO (or ZENON) OF ELEA (c. 488 B.C.-?), philosopher, was born about 488 B.C. at Elea, or Velia, in southern Italy. He was the son of Teleutagoras and flourished about 500 B.C. A disciple of Parmenides, he accompanied him to Athens, where Pericles became one of Zeno's pupils. In his doctrine Zeno followed the Eleatic school respecting the immutability of all things and the unreality of phenomena. He is famous for introducing the style of argument known as "Dialectics."

See F. Cajou, *History of Zeno's Arguments Against Motion*.

ZENOBIA, Queen of Palmyra. Together with her husband Odenaethus and continuing after his death, c. 266 A.D., she extended the commercial empire of Palmyra and disputed Rome's control of Syria. The emperor Aurelian after defeating her army near Antioch and again near Emesa, besieged and captured Palmyra, c. 272. After adorning Aurelian's triumphal entry to Rome, Zenobia was given a villa at Tibur, modern Tivoli, where she resided the rest of her days.

ZENTA. See **SENTA**.

ZEOLITES, a group of minerals, usually white or tinted shades of green, yellow or red, found chiefly in IGNEOUS ROCKS. They result from the alteration of FELDSPAR and feldspathoids such as NEPHELITE and LEUCITE by circulating waters and steam, and so consist of hydrous silicates of aluminium with sodium, potassium, or calcium. All the crystal systems are represented by various members in the group. A common occurrence of zeolites is in veins and cavities in such BASIC ROCKS as BASALT. They have been sometimes used for softening water, but synthetic compounds of similar composition usually serve this purpose. Fine specimens are sometimes cut for inferior GEM STONES. New Jersey and the copper deposits of Michigan are noteworthy localities for zeolites. See also METAMORPHISM.

ZEPHANIAH, BOOK OF, one of the minor prophetic books of the Old Testament, derives its name from a Hebrew prophet who preached about 642 to 611 B.C. In the Douay Bible, the Roman Catholic canon calls it the *Prophesy of Sophonias*. He is often termed "the prophet of doom" because of the violence of his denunciations against the sins of his own race and of other nations; "neither their silver nor their gold shall be able to deliver them in the days of the Lord's wrath," he says. The book closes with promises of better times for "the remnant of Israel," after "all the earth" is "devoured with the fire of my jealousy."

ZEPHYRINUS, ST. (?-217), bishop or Pope of Rome from 198 to 217, is known only from this fact. He was described by early church writers as "a simple man without education," probably meaning that he had not made the higher theological studies. In his time the Christians of Rome came into possession of a common burial place on the Via Appia, and Zephyrinus put Callixtus in charge of the cemetery. He was himself buried there after his death, Dec. 20, 217.

ZEPHYRUS, in Greek mythology, the personification of the west wind, was son of Astraeus and Eos and husband of Chloris, goddess of flowers. By her he was the father of Carpus. The Harpy Podargi bore to him the horses Xanthus and Balius.

ZEPPELIN, FERDINAND, COUNT VON (1838-1917), German inventor and aeronautical engineer, was born at Constance, Baden, July 8, 1838, son of Count Friedrich von Zeppelin. He was given a technical education at the Stuttgart Polytechnicum, Ludwigsburg Military Academy and at the University of Tübingen. After graduation he entered the army, and was sent to the United States in 1863 as a German observer with the Army of the Potomac. He made his first balloon ascension at St. Paul, Minn., and returning to Germany engaged in the war against Austria, in 1866, and the Franco-Prussian War, 1870-72. During the following 20 years Count Zeppelin was promoted up the army ranks, retiring in 1891 with the rank of lieutenant-general. He then devoted all his time and resources to the study of dirigible balloons.

In 1900 Zeppelin demonstrated his first dirigible, which remained in the air for 20 minutes, and in 1908 he built dirigibles, otherwise known as Zeppelins, capable of making journeys of from 350 to 1,000 miles. Zeppelin believed his dirigibles would prove a deadly war instrument against France, England and Belgium. Although the ships made many bombing raids, Allied anti-aircraft weapons destroyed 40 of the dirigibles, and their military efficacy remained doubtful even in spite of post-war development. Zeppelin himself was disappointed in the war-time behavior of his ships. As peace-time passenger carriers, however, the post-war types of dirigibles, developed at the Zeppelin works at Friedrichshafen, Germany, and at the Goodyear-Zeppelin plant at Akron, O., have substantiated in large part the soundness of Count Zeppelin's contentions. In 1929 Hugo Eckener navigated the *Graf Zeppelin*, named after the German inventor, in the first 'round-the-world flight by a dirigible. See also AIRSHIP. Zeppelin died at Charlottenburg, Mar. 8, 1917.

ZERO, in arithmetic, the quantity defined by the equations $a + 0 = a$, $a \times 0 = 0$. In ANALYTIC GEOMETRY, the point of the origin of a coordinate system is called the zero point. In the graphic representation of a real-number system it is the point separating the positive from the negative number scale. On a thermometer it divides artificially the positive from negative temperatures. The absolute zero of temperature is estimated at -273.7° Centigrade. See THERMOMETRY; ABSOLUTE TEMPERATURE SCALE.

ZEROMSKI, STEFAN (1864-1925), Polish novelist, poet and dramatist, was born at Strawczyn, Kielce, Poland, Nov. 14, 1864. The Russian Government exiled him in early youth, but he became, nevertheless, one of the recognized leaders of Polish literature among the older generation. His works include a collection of short stories, 1895, a novel, *The Story of Sin*, 1906, a trilogy, 1916-18, partially summing up his life

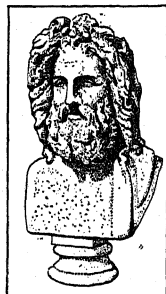
and work, and the *Broken Spell*, a political drama. Zeromski died at Warsaw, Nov. 20, 1925.

See W. Jampolski, *Stefan Zeromski*.

ZEUGLODON, the oldest known fossil whale, perhaps the earliest sea-going mammal. Colossal zeuglodon vertebrae, the largest weighing 60 lbs., occur in Eocene deposits of the Gulf states of North America, in southern Europe, and northern Africa. In appearance this ancient cetacean was quite unlike existing whales, its proportions suggesting rather a huge sea-serpent. Its trunk nowhere exceeded 6 to 8 ft. in diameter, and of its total length of 70 ft., 40 belonged to the slender, supple tail which ended in a fluke, indicating a strong diver. A pair of short fore-paddles, like the flippers of a seal, appeared just behind the crocodile-like head, but the vestigial hind limbs were encased in the skin. From the shape of the formidable, double-rooted back teeth, which indicate descent from land-living flesh-eaters, zeuglodon takes its name, meaning "yoke tooth." The animal apparently disappeared from the ancient seas during Eocene time.

ZEUS, in Greek mythology, the chief god of Olympus, the same as the Roman **JUPITER**. He was the son of **CRONUS** and **RHEA**, and the husband and brother of **HERA**. The early seat of his worship was Dodona, where **DIONE** appears as his spouse; later Olympia became the more important center, and here Hera was looked upon as his queen. The Olympian games were celebrated every four years in Zeus's honor. At Athens he had a splendid temple, situated southeast of the Acropolis; in this city his mysteries were called the *Dipolia*. In Arcadia, on Mt. Lycaeus, human sacrifice was made to Zeus, the officiating priest afterwards fleeing to the woods, where he was changed into a wolf for nine years. Zeus revealed the future through rustling of leaves, birds, dreams and other omens. The god's attributes were the eagle, wolf, oak, and thunderbolt.

ZEUS OTRICOLI, the most famous of the many interesting antiquities excavated at the town of Otricoli in Umbria, Italy. This marble bust is of the usual leonine type, especially in the disposition of the hair and beard. It was once thought to be a copy of the celebrated Olympian Zeus of Phidias. Recent students, however, consider the style to be that of a later century, probably the 4th century B.C. The bust is now in the Vatican Museum.



COURTESY P. P. CAPRONI
AND BROTHER

ZEUS OTRICOLI
In the Vatican

ZHITOMIR, a city of the Ukrainian S.S.R., situated in southwestern Russia on the Teterev River, about 80 mi. southwest of Kiev. The city was once an important Jewish center of trade and the seat of Roman and Greek Catholic bishops. It has lost its former importance but still has fairly large breweries and iron foundries. Hops are raised in the surrounding district. Pop. 1926, 76,678.

ZIGGURAT or **ZIKKURAT**, a temple form of the ancient Babylonians, Chaldeans and Assyrians. It consisted usually of a lofty stepped pyramid, built in successive stages, with outside staircases and a shrine at the top.

ZIMBALIST, EFREM (1889-), Russian violinist, was born at Rostov-on-Don, Apr. 9, 1889, the son of Aaron Zimbalist, an accomplished musician. He was a pupil of his father and of **LEOPOLD AUER**. In 1907 he made an outstanding tour of European cities. In 1912 he settled in the United States. He has composed Slavic dances for violin and piano, songs, and an orchestral suite.

ZIMMERMAN, ARTHUR (1864-), German diplomat, was born at Frankenstein Oct. 5, 1864. He studied law, and early entered the foreign service, going to Shanghai as vice-consul in 1898, thence as director of the consulate at Canton, and in 1900, as consul to Tientsin. In 1904 he was entrusted with the political division of the Foreign Office on Far Eastern and Turkish affairs, and in 1910 became director of the general political division of the office. From 1911-16 he was under-secretary of Foreign Affairs. During the war he was Secretary of State for Foreign Affairs from Nov. 1916-Aug. 1917 and advocated the fateful policy reflected in the "Zimmerman Note" of Jan. 1917 to Mexico. The note was discovered by United States authorities and contributed a great deal to our entry into the World War in April.

ZIMMERMAN, JOHANN GEORG (1728-95), Swiss physician and philosophical writer, was born in Brugg, Canton of Aargau, in 1728. He studied at Göttingen and in 1754 became town physician at Brugg. He is the author of *Von der Erfahrung in der Arzneikunst*, 1764, a medical treatise of some importance. His works of a philosophical nature are *Ueber die Einsamkeit*, 1755, and *Von Nationalstolz*, 1758. In 1758 Zimmerman became court physician at Hanover and in 1786 attended Frederick the Great in the latter's last illness. The account of his experience with the famous monarch he wrote up in 1788. He died in 1795.

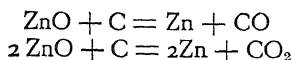
ZINC, a bluish-white metal, chemical symbol Zn, atomic weight 65.38, specific gravity 7.0, which melts at 419.4° C. (787° F.) and boils at 930° F. Zinc is widely distributed; its principal ores being sphalerite (ZnS), zincite (ZnO), calamine ($2\text{ZnSiO}_3 + \text{H}_2\text{O}$), smithsonite (ZnCO_3), willemite (Zn_2SiO_4) and franklinite, $(\text{Fe Zn Mn})\text{O} \cdot (\text{Fe Mn})_2\text{O}_3$.

Modern zinc smelting was first carried on near Bristol, England, in 1743 although the Chinese probably produced impure zinc before 600 B.C.

Methods of Production. Zinc is produced commercially by the following methods:

Retort Process. Oxide or roasted sulphide zinc ores mixed with fine anthracite, culm, non-coking bituminous coal or coke breeze are charged into retorts. A zinc furnace contains between 260 and 800 retorts, arranged in horizontal rows, that are heated externally. When the ore and coal mixture in the retorts reaches about 1100° C. the carbon in the coal reduces the

zinc ore by several reactions the following of which are typical:



Since reduction takes place above its boiling point, the zinc goes off as a vapor. Each retort is fitted with a condenser which collects the molten zinc so that it can be withdrawn and cast into zinc slabs.

A modification of this process uses a large vertical retort into the top of which ore and coal are charged, the zinc reduced, the refuse discharged from the bottom and the zinc vapor condensed and cast.

Electrolytic Method. Properly roasted or treated ores are leached with SULPHURIC ACID, the resulting zinc sulphate solution purified and electrolyzed in a cell employing a lead anode and an aluminum cathode. The pure zinc deposits are stripped periodically from the cathodes, melted and cast into slabs.

Electrothermic Method. This is similar to the vertical retort method except that less reducing coal is used and the equivalent heat is supplied by an electric resistance furnace.

Uses. At 100° to 150° C., zinc may be hammered, rolled or pressed. This leads to its use in zinc sheets, building materials and other products. Other uses are for GALVANIZING or sheradizing iron, production of zinc oxide by the French Process, desilverization of lead and the production of alloys such as brass, bronze, German silver, bearing metal and die castings. *See also ZINC ALLOYS (below); ZINC OXIDE.*

Production. Zinc production figures in tons (2000 lbs.) for recent years are:

	1920 Tons	1925 Tons	1930 Tons
United States	479,669	590,928	504,412
All Other Countries	331,868	674,786	1,058,637
Total.....	811,537	1,265,714	1,563,049

F. O. C.

Zinc Alloys. Slab zinc (spelter) finds its most important uses in galvanizing, manufacture of brass and other copper alloys (*see COPPER*), die castings, and in wrought form. Other uses are in primary batteries, slush and permanent mould castings, and in numerous miscellaneous applications.

The use of zinc for die castings has increased greatly within the last decade and has already reached important proportions in this rapidly growing industry. The successful use of zinc in this field has been due to the development of zinc alloys with the requisite permanence, strength, and casting properties.

Sheet and strip zinc are used for roofing, dry batteries, drawn and pressed articles, photo-engraving, and lithographing. Recently, zinc alloys have been developed which, when rolled, are stiffer and stronger than unalloyed zinc.

The properties of zinc to which the wide use of the metal is chiefly due are its resistance to the atmosphere and the cheapness with which it can be applied to iron, resulting in universal utilization of galvanized

materials; its chemical activity as evidenced by its use in batteries, for etching, and in chemical processes such as hydrogenation and precipitation of heavy metals; the wide range of solid solutions formed with copper, resulting in the ductile metal brass with its many applications. Its low melting point, low volume cost, the strength of its alloys, and the ease with which they may be finished by plating, make it a superior metal for DIE CASTING.

C. S. T.

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ZINC ACETATE, a salt of zinc, formula $\text{Zn}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 3\text{H}_2\text{O}$, in the form of white pearly crystals having a faintly acetous odor; soluble in water and freely soluble in alcohol. Because of its astringent and antiseptic qualities, it is used chiefly in solution for external application as in burns and skin eruptions and for eye drops. It is not used internally.

ZINC CHLORIDE, a white or nearly white granulated powder (ZnCl_2), or in porcelain-like irregular masses, or molded into pencils. Many of its reactions are like those of ZINC ACETATE, though it is more reactive. It is an active escharotic and therefore often found as an ingredient in fake cancer pastes.

ZINCITE, a deep red to orange-yellow mineral, an ORE of zinc found only at Franklin and Sterling Hill, in New Jersey, where the minerals willemite and FRANKLINITE also occur. The ore bodies, made up of these minerals, are thin, sheet-like masses lying within a bed of MARBLE. There is much discussion amongst geologists concerning the probable origin of these deposits, which also produce iron and manganese. Zincite is zinc oxide, crystallizing in the HEXAGONAL SYSTEM. *See also ORE DEPOSITS.*

ZINC OXIDE, a white or yellowish white powder, formula ZnO . It is sometimes known as zinc white, a white pigment of considerable importance. It is an excellent pigment for paints, varnishes and lacquers as it is non-poisonous and gives an unchanging surface; it is also extensively used in the rubber industry. Zinc oxide paints do not change under the influence of sulphur gases. Their covering power is less than that of white lead.

There are two processes for the preparation of zinc oxides. In one, zinc metal blocks are placed in fire-clay retorts and raised to white heat at which the zinc volatilizes and meets a current of hot air. This oxidizes the metal and produces zinc oxide. The second process consists of heating zinc ores with carbon in special furnaces. The zinc is reduced, oxidized and then condensed through a series of chambers. This method produces zinc white and snow white. *See also ZINC; PAINT.*

Medicinally, zinc oxide is slightly antiseptic and astringent and is used either alone or in combination with a variety of other substances as a dusting powder, or in zinc oxide ointment as a sedative or protective for skin diseases. Zinc oxide is rarely used internally.

P. N. L.

ZINNIA, a genus of herbs and subshrubs of the composite family several of which are cultivated for

their showy flowers. There are about 12 species, natives of North and South America but most numerous in Mexico; 5 occur in the southern United States. The usually erect stems bear opposite, mostly entire, sessile leaves and conspicuous solitary flower-heads at the ends of the branches. The most popular garden zinnia (*Z. elegans*), often called youth-and-old-age, is a native of Mexico. It is an erect annual, 1 to 2 ft. high, with purple or lilac flowers which, by cultivation, have been developed into many double forms varying to almost every color except blue and green. Zinnias are of very easy culture thriving in any good garden soil and producing an abundance of summer and autumn bloom.

ZINOVIEV, GIRGONY EVSEVICH RADO-MILSKY (1883-), Bolshevik, was born at Novomirgovod, Russia, in Sept. 1883. He studied law for a time but in 1903 met LENIN and soon afterward joined the Bolshevik party. He carried on the propaganda of his party in Russia until 1908, when he was imprisoned, released, and later banished. In 1912 he was with Lenin in Galicia, helping with the publication of Bolshevik literature. He was among the leaders of the Bolshevik seizure of power in 1917 and in 1919 became President of the Third International and Chairman of the Leningrad Soviet. In the latter capacity he exercised great power, taking particular interest in education, which fact caused the University at Leningrad to be named for him. Upon the death of Lenin, Jan. 21, 1924 the leadership of the Soviet Union came into the hands of the so-called triumvirate: STALIN, Zinoviev and Kamenev. During 1924 Zinoviev and TROTSKY quarreled, Trotsky desiring the overthrow of the New Economic Policy while Zinoviev unwillingly endorsed it. In October of that year the "Red Letter" published in the London Times and alleged to have been written by Zinoviev, stopped the efforts of Labor to establish friendly relations between England and Russia, and contributed to the Conservative victory in the election of Oct. 29. The letter, the authenticity of which has never been established, urged the British laboring classes "to work for the violent overthrow of existing conditions." In December, 1925, disagreement broke out between the members of the triumvirate, Stalin's policy of compromise with peasants being opposed by Zinoviev and Kamenev, who desired the continuation of complete control of the industrial proletariat. Through 1926 there was a struggle within the Communist party, Stalin leading the majority while Trotsky, Zinoviev and Kamenev headed the more radical opposition. Stalin was successful in the central committee of the Communist party; Zinoviev failed to secure reelection to the presidency of the Leningrad Soviet and was expelled from the political bureau of the party. During 1927 Zinoviev and the other opposition leaders appealed to the country and there was much demonstration in their favor. Early the next year Zinoviev and Kamenev were readmitted to the party and aided Stalin in stopping a trend toward the Right which had threatened. Zinoviev was again in office in 1929

as director of the western department of the Komintern. In addition to his other activities, Zinoviev has published several books, including a life of Lenin.

ZINOVIEVSK, formerly Elizavetgrad, railway center in southwestern Ukrainian S.S.R., in the slopes of two hills, between which flows the Ingul River. The town was founded in 1754 and has experienced a turbulent history. Fighting during the civil war following 1917 took place here and was terminated only in 1921. The grain trade is of first importance and both grain and wool are extensively exported throughout the region. Agricultural machinery and implements are the leading industrial products. Other noteworthy enterprises are smelting, brewing, tobacco, beer, and soap-making. Pop. 1926, 66,467.

ZINZENDORF UND POTTENDORF, COUNT NICHOLAS LUDWIG VON (1700-60), German religious reformer, was born at Dresden, May 26, 1700. He was educated at Halle and Wittenberg, preparing himself in law and diplomacy at the latter from 1716 to 1719. Deciding to devote his life to moral and religious uplift, he retired to his estate at Berthelsdorf, and began a revival of religion along the lines of Spener's pietism. He published a great number of religious books and pamphlets, and founded Herrnhut on his estate as a place for MORAVIANS and other religious refugees. He organized these into the Moravian Brethren, and gave them an order of worship. From Herrnhut he sent out missionaries to the far corners of the earth. He himself became a bishop of the Moravian church. In 1736 he was exiled from Saxony, but was allowed to return in 1755. In behalf of his brethren he traveled much in America in 1741-42 and in England in 1750. He died at Herrnhut, May 9, 1760.

ZION, in Biblical reference, the name of the Jebusite fortress at Jerusalem seized by David (II Samuel 5). Zion was the name of the southern part of the eastern hill upon which the temple was built.

ZION, a city of extreme northeastern Illinois, in Lake Co., situated on Lake Michigan, 42 mi. north of Chicago. The Chicago and North Western, and the North Shore railroads serve the city, which has diversified industries and derives trade from the fruit-growing and dairying vicinity. In 1899, JOHN ALEXANDER DOWIE (1847-1907), founder of the "Christian Catholic Apostolic Church in Zion," was enabled by the contributions of his followers to obtain a site of 10 sq. mi. where they established their headquarters with a central Zion temple as the only place of worship. This settlement was called Zion City and chartered in 1902. Pop. 1920, 5,580; 1930, 5,991.

ZIONISM, a movement aiming at the reintegration of the Jewish people by their national settlement in Palestine. The Return effected under Ezra, Nehemiah and Zerubbabel is a symbol of what is practically and spiritually encompassed in the idea. Restoration was part of the Messianic concept evolved by the Jews immediately after the destruction of Jerusalem, 70 A.D., and explains the direct military struggles and semi-messianic movements in Palestine

from 85-614 when the Jews, aiding Chosroes II, took part in the capture of Jerusalem. To that date and perhaps later the Messianic idea involved the re-establishment of the theocratic state, rebuilding of the Temple and reinstitution of sacrifices. From Omar's entry into Jerusalem, in 636, the politico-military phase gradually disappeared, giving place to religious-mystical attitudes embracing gradually more and more of the millennial concept. This was expressed in a fairly long line of pseudo Messiahs to the 18th century. The Return, adumbrated in the Biblical promises and prophetic allusions to the turning of the captivity, became a yearning by the frequent references to the rebuilding of Jerusalem in the daily prayers of orthodox Jews. These sentiments were first countered by the attitude of the Sanhedrion convened by Napoleon, 1805, and the subsequent formal denial of national attitudes and aspirations by the Reform wing of Judaism. To 1850 the desire for Jewish independence only twice assumed semi-practical aspects. In the 16th century Joseph Nasi, Duke of Naxos, sought a charter for Jewish settlement in Palestine, and at the beginning of the last century Mordecai Manuel Noah proposed such a settlement at Grand Island, Niagara.

Following the capture of Palestine by Mehemet Ali in 1832 Jews flocked again in numbers to Palestine, and agricultural settlement was encouraged by Sir Moses Montefiore. The Crimean War aroused interest in England and France in Jewish political autonomy in Palestine, and from Lord Kitchener to Maj. Conder, the field workers for the Palestine Exploration Fund with Earl Shaftesbury, all advocated this solution of one phase of the Near Eastern Problem. Practically every Palestinian travel book of the 19th century speculated on this theme, and the subject can be traced through a considerable literature dealing with the poetic, prophetic, Biblical, political and religious aspects. George Eliot advocated the idea in *Daniel Deronda*, and Laurence Oliphant (1829-88) attempted practical colonization in Gilead. Among the Jews, Moses Hess by his *Rome and Jerusalem*, 1862, started a new consideration of the problem. The discussion was continued by a number of writers till at the outbreak of the Russian riots in 1881-82, M. L. Lilienblum and P. Smolenskin gave acute consideration to a new phase, by stressing the reality of the Jewish question, and the unendurable and destructive effects of the mixture of dispersion and persecution under which the majority of Jews lived. This resulted in the birth of the Chovevei Zion (Lovers of Zion), a nationalistic "back to the soil" movement. The first colonies or agricultural settlements were founded in 1882 in the Plain of Sharon. This practical process, largely aided by the munificence of Baron Edmond de Rothschild, owing to Turkish opposition, had a checkered career; but the movement to aid and encourage it took form in all parts of Europe and in the United States.

Organization of Political Zionist Movement. In 1896 THEODOR HERZL advanced his Jewish State

idea and roused the interest of Jews in considerable masses by adumbrating the Jewish need, and emphasizing the political economic phases of his plan. He and MAX NORDAU and others were immediately aided by Jewish Nationalists; interest was concentrated on Palestine, and the political Zionist movement organized. The First Zionist Congress, held Aug. 1897, at Basle, Switzerland, adopted as its platform a "legally assured publicly secured home in Palestine" for the Jewish people. From 1906-15 the central authority of the movement was located in Germany; but with the World War American participation became prominent, and the center of gravity was moved to New York where under the leadership of Justice LOUIS D. BRANDEIS, aided by Rabbi STEPHEN S. WISE, Judge Julian W. Mack, Prof. Felix Frankfurter, Jacob deHaas, the late NATHAN STRAUS and many others, an Emergency Committee raised funds to maintain the Jewish *status quo* in Palestine and advance the political fortunes of the movement.

In the meantime the Palestinian problem had become part of the war issues. As a result of negotiations which began with a conference in London in which Dr. CHAIM WEIZMANN, NAHUM SOKOLOV, Dr. Moses Gaster and Sir Herbert Samuel for the Zionists and M. Picot and Sir Mark Sykes for the French and British Governments took part, the problem was submitted to the various war cabinets and to President Wilson, who warmly espoused the cause. Supported by American Zionists and with the agreement of President Wilson the British war cabinet on Nov. 2, 1917 issued the Balfour Declaration, "in favor of the establishment in Palestine of a national home for the Jewish people, it being clearly understood that nothing should be done which might prejudice the civil and religious rights of existing non-Jewish communities in Palestine, or the rights and political status enjoyed by Jews in any other country." All the Allies publicly approved this declaration. A Zionist delegation appeared before the Peace Conference. In 1920 the mandate for Palestine was awarded to Great Britain, and on June 30, 1920 Sir Herbert Samuel assumed office as the first High Commissioner for Palestine. In 1922 the terms of the mandate for Palestine and Transjordan were ratified by the Council of the League of Nations, and the preamble after quoting the Balfour Declaration added "whereas recognition has thereby been given to the historical connection of the Jewish people with Palestine and to the grounds for reconstituting the national home in that country." In Sept. 1922 Transjordan was administratively divorced from western Palestine.

With the beginning of the establishment of a civil Government in Palestine Jews began to flock readily into the country (there are to-day in excess of 100 agricultural settlements, primarily engaged in mixed farming, citrus and viticulture), built the city of Tel Aviv, constructed new suburbs in Jerusalem and Haifa, established about 3,500 small industrial plants, and organized a complete educational and health system throughout the cities and villages, from kinder-

gartens to trade schools, crowned with the Hebrew University and National Library on Mount Olivet.

The three outstanding industrial developments are the Ruttenberg Hydro-Electrification of the Jordan, the Nesher Cement works at Haifa, and the manufacture of potash and other chemicals from the mineral resources of the Dead Sea. It is estimated that from 1900-32 the Jewish capital brought into Palestine amounted to \$225,000,000. On the intellectual side may be counted the revival of Hebrew as a spoken tongue with its daily and weekly newspapers, a multitude of books of every description published in Palestine in Hebrew, English and Arabic, numerous exhibitions displaying local efforts in the plastic arts, the creation of Hebrew folk songs, interest in music, frequency of concerts, and the formation of a Hebrew opera company.

Protests of the Arabs. The Arabic speaking natives have since 1919 protested against the Balfour Declaration, later against the terms of the mandate, and even against the presence of the mandatory. In 1922 the Churchill White Paper sought to overcome some of these grievances, but the Arabs then refused to join an advisory council, and have continued their protests, and organized boycotts against the Jews. In Aug. 1929 a serious riot took place over the Jews' claim to use the Wailing Wall as a place of prayer. Following the 1929 riots the Shaw Commission was sent by the British to investigate. In 1930 there was issued the Passfield White Paper, which was followed by Sir John Hope Simpson's report on the landless Arabs, and in Feb. 1931 the MacDonald Letter in explanation of the Passfield document. In the early part of 1932 there was in process of issuance the French report on the Arabs, presumed to have been made landless by the purchase of their lands by Jews. The conduct of the mandatory power, the development of the Jewish National Home, and the Arab Executive protests are reviewed annually by the Permanent Mandates Commission of the League of Nations. In all 17 congresses, including 1931, have been held, an organized world wide executive has functioned and many necessary financial and other instrumentalities created. There are units of the organization, federations, regional groupings and local societies in every country.

Followers are divided between political Zionists interested exclusively in the Palestinian development phase, and those who divide that interest with national cultural Jewish aspirations elsewhere. Party interest has developed three organized groups: Miz-rachi, or religious; Labor, or Socialistic, and the center, or middle class. Post-war additions are the Revisionists, or Jewish statistis, and Radicals. The Women's Movement, largely represented by American effort, takes the form of close attention to health problems in Palestine and is named Hadassah, while the European feminine phase is known as the Women's International Zionist Organization.

Under the Mandate the Jewish development is to be directed by the Jewish Agency, which originally

was the Zionist Organization, and now is the extended Jewish Agency representing all phases of Jewish interest in Palestinian development. The extended Agency was formed at Zurich in 1929, and its second council meeting was held in Basle, Switzerland, in 1931. The president of the World Zionist Organization is automatically the president of the Jewish Agency. J. DE H.

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ZION NATIONAL PARK, in southwestern Utah about 100 mi. north of the Grand Canyon, was established by act of Congress approved Nov. 19, 1919 and was enlarged June 13, 1930 to its present area of 148.26 sq. mi.

The principal feature of this park is the deep gorge cut by the Mukuntuweap River to a depth of 2,500 ft. through rock strata fantastically eroded and as brilliantly colored as a Roman sash. The vivid red of the famous Vermilion cliff, visible for over 100 mi. across the desert, is the predominant color of the canyon. This cliff, like the other walls and temples of the canyon, is a gorgeous red for the lower two-thirds of its height and then rises in startling white. In some instances, the white is surmounted by another red stratum, a vestige of a layer which once overlay the entire region. Mauve and purple shale and other richly variegated strata intensify the amazing richness of the coloring.

The entrance to the park is guarded by two huge stone masses known as the East and West Temples. West Temple is the greatest of the stone mountains of Zion Canyon and one of the great monoliths of the world. It rises to a height of over 4,000 ft. of which the lower two-thirds is red and the upper third white.

A total of 15¾ mi. of improved automobile highway and approximately 26 mi. of saddle horse trails lead to important scenic points. Practically all points are accessible by foot paths.

Zion National Park is reached by motor stage service from either Cedar City, Utah, on the Union Pacific system or from Marysville, Utah, on the Denver and Rio Grande Western Railroad. Motorists on the Arrowhead Trail, U.S. 91, turn off at Anderson's Ranch and travel east. From the Grand Canyon Highway, U.S. 89, motorists turn west at Mount Carmel Junction and enter the park at the east entrance via the remarkable Zion-Mount Carmel Highway. The official season extends from June 1 to Sept. 25, although visitors with their own camping equipment may enter at any time during the year.

ZIRCON, a rock-forming mineral whose properties make it also a valuable gem material. It is next after

the DIAMOND in brilliancy and fire, and ranks quite high in hardness, properties which warrant its greater use as a gem. Zircon is found in a variety of colors, from colorless, through blue, green, yellow, red, brown to gray. The gem species are transparent, but the mineral may also be opaque. In composition, it is a zirconium silicon oxide, and crystallizes in the TETRAGONAL SYSTEM. The color is thought to be due to iron and other impurities. The recently discovered element, hafnium, is often present.

The names hyacinth and jacinth are applied to the clear, yellow to brown zircons, and jargon or jargoon to most of the other colors. Matura diamond is the name given to colorless zircons from Ceylon. Blue zircons come from Siam. Other sources are in France, Australia and Russia. The gem zircons come mostly from PLACERS, the original rocks from which they are derived being GRANITES and PEGMATITES.

Zircon is also used as a refractory, the metal zirconium for hardening steel, and the oxide zirconia in incandescent mantles. North Carolina possesses well-known deposits of zircon sand. *See also* GEM STONES.

ZIRCONIUM, a metallic element, symbol Zr, atomic weight 91.22, density 6.4. In the PERIODIC SYSTEM of the elements it occurs in the fourth group, and is therefore tetravalent. The metal is easily oxidized to ZrO_2 , a very stable compound, and combines with hydrogen, nitrogen and silicon. The chloride is made by the action of chlorine on a mixture of ZrO_2 and carbon at red heat, or by the action of carbon tetrachloride on ZrO_2 at red heat. The chloride reacts violently with water with the formation of the oxychloride $ZrOCl_2$. Zirconium oxide is used in the industries as a refractory and in glazes for enamelware. The most important natural occurrences of zirconium are the minerals, baddeleyite (ZrO_2) and zircon ($ZrSiO_4$). In all the natural sources zirconium has associated with it the similar element HAFNIUM, recently discovered by Hevesy.

J. M. B.

ZITTAU, a German city in southeastern Saxony, about 50 mi. southeast of Dresden, on the Mandau River just before it joins the Neisse. It is the Saxon center of the damask and linen trade, sends large quantities of yarn to Bohemia and deals in drugs and chemicals. A Slavic settlement, it has been Saxon since 1643. Pop. 1925, 38,353.

ZLOTY, the Polish monetary unit, a silver coin, equivalent to 11.22 cents at par. It was introduced in 1924, when it replaced the Polish mark.

ZMAJ. *See* JOVANOVIĆ, JOVAN.

ZNOJMO or **ZNAIM**, a Czechoslovak city in Moravia on the steep bank of the Dyje River. It has a Gothic Church of St. Nicholas built in 1348, a Dominican Monastery founded 1222, a Gothic city hall dating from 1445, remains of the castle of the Moravian margraves, a Romanesque chapel of the 12th century and fine gardens. Large quantities of grapes, fruit and vegetables are grown. There is considerable manufacture of earthenware, leather, vinegar, preserves, and other commodities. In 1955 Znojmo was

the seat of a principality and was throughout the centuries a meeting place for emperors, king and princes. Pop. 1921, 21,197.

ZODIAC, a belt in the sky 18° wide, 9° on either side of the sun's path and comprising the twelve constellations ARIES, TAURUS, GEMINI, CANCER, LEO, VIRGO, LIBRA, SCORPIUS, SAGITTARIUS, CAPRICORNUS, AQUARIUS and PISCES. It derives its name, zone of animals, from the fact that 11 of these represent living objects. The exception is Libra, the Balance.

ZODIACAL LIGHT, a faint plume of light, seen shortly after sunset or shortly before sunrise, which follows the sun around in its course through the ZODIAC.

ZOISITE, a rock-forming mineral which is sometimes cut for ornamental objects or cabochon for jewelry. It is related to EPIDOTE, into which it may grade through iron replacing the aluminium in it. Chemically, it is hydrous silicate of calcium and aluminium, crystallizing in the ORTHORHOMBIC SYSTEM. The color is variable, and may be gray, yellowish, greenish, or peach-blossom red to rose red, and ranging from subtranslucent to transparent. Thulite, the red variety, comes from Norway and Italy.

It is a common mineral in the SCHISTS which have been metamorphosed from IGNEOUS ROCKS containing certain PAGIOCLASES. *See also* GEM STONES; METAMORPHISM.

ZOLA, ÉMILE ÉDOUARD CHARLES ANTOINE (1840-1902), French novelist, was born in Paris, Apr. 2, 1840. Left fatherless at an early age, he grew up in poverty and as a young man worked as a clerk in the book-selling firm of Hachette. His first literary work was *Contes à Ninon*, published in 1864. His novel *Thérèse Raquin*, 1867, attracted attention and Zola thereupon decided to write a series of novels relating minutely the social history of the Rougon-Macquart family. Volume after volume appeared but it was not until 1877, when *L'Assommoir*, his powerful study of drink, was published, that he became popular. Twenty novels composed the Rougon-Macquart series, and with them Zola became the richest and most discussed novelist in France and the undisputed founder and leader of the Naturalistic School. Among his notable and most characteristic works are *Nana*, *La Débâcle*, *Germinal*, 1885, and *La Terre*, 1888. Zola won further fame as an ardent supporter of ALFRED DREYFUS. He died in Paris, Sept. 29, 1902, accidentally asphyxiated as a result of a defective stove flue. *See also* FRENCH LITERATURE.

ZOLLVEREIN, a union of independent nations, which provides for free trade (*see* FREE TRADE AND PROTECTION) between the members and a common tariff against goods imported into the union from other nations. It is another name for a CUSTOMS UNION.

Specifically, the term refers to the customs union of the German states prior to the establishment of the Empire. This union started with the movement inaugurated by Prussia in 1818 for lower tariffs between the small nations and principalities of central

Europe. These states were mutually dependent economically and their commercial development had been seriously retarded by the multitude of tariff restrictions. The gradual removal of these restrictions led to the formation in 1834 of the complete Zollverein. At first the union included merely the states of northern Germany, but eventually was extended to all of the later Empire and also included Luxemburg. The union became unnecessary, of course, when the Empire was created in 1871.

The organization was simple. It was formed by a series of treaties between the members. At first, it was governed by an annual meeting of representatives of the members, unanimous actions being required for any important change. This was later changed by the creation of a council with questions settled merely by vote of majority. The division of the revenue from the common tariff was based on the population of each country. A. F. L.

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ZOMBOR. See **SOMBOR**.

ZONE, in geography, a large subdivision of the earth's surface whose boundaries are formed, at least approximately, by parallels of latitude. Thus the tropical zone is that belt contained between the parallels of $23\frac{1}{2}^{\circ}$ north and south, while in climatology the tropical zone is often taken as being bounded by certain annual **ISOTHERMS**, irregular lines, which follow only roughly these same parallels of latitude.

ZONING, a term applied to the districting of a city by ordinances which specify the industries that may be established and the sizes and classes of buildings which may be erected in these different sections, or "zones." The object is to prevent bad housing conditions in industrial centers and injury to residential sections by encroachment of objectionable industries. Zoning is also used in assessing real estate as well as such public improvements as pavements, sewers, etc. *Traffic zones* are mapped out to show the system of highways required in any area to serve adequately the traffic within that area. See also **BUILDING LAWS**.

ZOOK, GEORGE FREDERICK (1885-), American educator, was born at Fort Scott, Kan., Apr. 22, 1885. He graduated from the University of Kansas in 1906 and took his Ph.D. at Cornell University in 1914. From 1912-20, he was on the Pennsylvania State College faculty, and during this time held various government educational posts. He was chief of the Division of Higher Education, United States Bureau of Education, 1920-25, and became president of the University of Akron, in 1925. His publications include *The Royal Adventurers Trading into Africa*, 1919, and *America at War*, 1918.

ZOOLOGICAL GARDEN, land set apart for the housing and display of live wild animals. Although the term is used interchangeably with zoological park, the gardens are, strictly speaking, tracts of from 20 to 60 acres within a city, while zoological parks cover from 100 to 300 acres, outside city limits, in naturally wild surroundings.

In the United States, such parks are usually maintained by public-spirited societies supported by gifts and memberships, and are open to the public free or at a nominal admission. In other countries this system is sometimes followed, but there are also many government-owned exhibits as well as menageries operated for profit by private companies.

From the days of antiquity, when captive wild beasts were sent as rare gifts to ruling potentates, the exhibition of caged animals has fascinated mankind. The first institution of the sort was founded in China about 1100 B.C. as an "Intelligence Park." The collections of beasts kept for gladiatorial purposes by the Greeks and Romans were hardly zoological gardens, but during the Middle Ages kings and feudal lords began to establish menageries, often including aviaries and aquaria. That founded by Henry I of England in the early 12th century was later transferred to the Tower of London and maintained until about 1828. Philip VI gave Paris a menagerie in 1333; Dresden had its animal exhibits in 1554. In 1793, Buffon and others were instrumental in founding the still-famous Jardin des Plantes in Paris. In 1826, 35 acres were set apart in Regents Park for the Zoological Society of London. The London Gardens, though small, are among the most notable in the world for their splendid collection and excellent care of the animals. Recently a large tract outside the city has been opened as a "natural" park where the animals live under the least possible restraint. In 1830 Dublin, Ireland, opened a "zoo" which to-day is particularly successful in breeding lions in captivity. The Royal Zoological Society of Antwerp was founded in 1843, and Copenhagen opened its park in 1859. There are similar institutions in most of the larger European cities. Germany, which in 1914 had 20 zoological gardens, has made considerable progress in reorganizing them since the war. The famous Tiergarten of Berlin was founded in 1844, under private ownership. Cologne and Hamburg have gardens of importance.

African animals are shown at Khartum and there are beautifully laid out grounds in the zoological park at Cairo, Egypt, and at Pretoria. Australia has gardens at Melbourne, Adelaide and elsewhere. In South America, Buenos Aires has the finest collection; there are others at Rio de Janeiro and Para, Brazil. In Asia the institution at Alipore, Calcutta, is the only one of note.

Probably the largest zoological park in the world and in many ways the finest is that maintained by the New York Zoological Society in Bronx Park, New York City. Founded in 1899, the Bronx "zoo" covers more than 300 acres, and while featuring native American animals, such as the almost extinct bison, it also has magnificent specimens from all over the world. The directors have succeeded remarkably in creating natural surroundings and at the same time arranging the exhibits for the greatest enjoyment of thousands of visitors. The Washington Zoological Park, founded in 1889 through the efforts of William T. Hornaday, later in charge of the Bronx collections,

is now under the direction of the Smithsonian Institution. Its wild and beautiful surroundings in Rock Creek Park have been preserved in spite of the city's growth. Lincoln Park, Chicago, and Highland Park, Pittsburgh, have excellent municipal zoological gardens. Philadelphia boasts the pioneer American institution, the first gardens having been opened in 1871.

Any zoological park includes some open air exhibits and some permanently housed, and requires a large staff of scientists and engineers to keep the animals healthy and comfortable. Heating shelters and buildings is of primary importance, as some specimens require high temperatures and others low. Cleanliness is imperative, and modern buildings have every advanced facility for sanitation. For the harder outdoor animals, the correct type of soil, rocks, drainage and water supply must be provided. Feeding is extremely difficult and an enormous variety of fresh foods is needed by any good-sized "zoo." The feeding habits of the animals, from the smallest birds which eat every few hours to the snakes which often go weeks without food, must be studied. The arrangement of the exhibits demands a compromise between the protection of the animals from too much attention and the desire of the public to see them. The bears, monkeys and elephants are the most popular animals. Another important activity is the preparation of printed matter, and the use of such other intelligent publicity as will further both scientific and popular knowledge.

ZOOLOGY, in the modern sense, the science of animal life (from Greek *zoon*, a living thing, and *logos*, discourse) as distinguished from **BOTANY**, the science of plant life. Both sciences together with **BACTERIOLOGY** constitute the science of **BIOLOGY**.

HISTORY OF ZOOLOGY

Man's interest in animals dates back to the earliest times. The records of early man demonstrate his dependence upon animals for food. He made clothes from animal skins, and tools from animal bones, horns, antlers and shells. Primitive religious observances not only symbolize man's every-day contact with animals, but indicate his early tendency to endow animals with human or superhuman qualities. From these original interests in animals, the scientific attitude toward animal life slowly emerged and developed with the slow progress of civilization.

The Greeks, among the ancients, were foremost in zoological science as in most fields of human endeavor. **THALES** (624-548 B.C.), **ANAXIMANDER** (611-547 B.C.) and **EMPEDOCLES** (495-435 B.C.) are names associated with early concepts of the origin and evolution of animal life. **ARISTOTLE** (384-322 B.C.) was the greatest of the Greeks from the standpoint of zoology. He applied inductive reasoning to many facts which he and his coworkers ascertained. Had his method of observation and formulation of principles based upon the facts of nature been continued without break, the science of to-day would be far in advance of its present attainment.

The science of zoology declined steadily after **ARISTOTLE**. **PLINY**, the elder, compiled fact and fiction concerning animals, and his works in the 1st century A.D. represent the peak of Roman natural history. **GALEN**, a Greek anatomist living in Rome during the 2nd century A.D., wrote works on human anatomy, largely based upon dissection of animals.

During the Dark Ages, man's mind turned away from sense perceptions toward the realms of mysticism and theology. The result was the total halt in the progress of zoology.

The scientific attitude, although suppressed for about a thousand years, emerged with surprising vitality with the great development of human thought that marks the beginning of modern history. Toward the end of the Middle Ages what little anatomy was taught was usually read to the students from the works of Galen. Both Galen and Aristotle were raised to positions of authority and questions of fact were often settled through recourse to these ancient works rather than through added examination of the facts of nature.

VESALIUS (1514-1564), a Belgian teaching in the University of Padua in Italy, deserves the greatest credit for overthrowing the authority of the ancients in the field of biology and applying the scientific method to the subject of human anatomy.

The experimental method of controlled observation was soon applied to zoological material. **William Harvey** (1578-1657), an English physician, is the best known of the early experimenters. (See **HARVEY**, **WILLIAM**.) He discovered the circulation of the blood. This discovery was of far reaching importance to medicine and was the foundation upon which **PHYSIOLOGY** rose, but it was undoubtedly his application of the experimental method that makes his work of prime importance in the history of zoology.

The 17th and 18th centuries witnessed the development of the microscope which was immediately used for observing minute organisms and microscopical structure of living forms.

Thus, with the establishment of scientific methodology and the invention of scientific instruments which extended the powers of the senses, zoology developed rapidly and during the 18th and 19th centuries, the various subspecies developed and flowered, a process of specialization which is continuing at the present time.

LINNAEUS (1707-1778), the great Swedish naturalist, collected and arranged representative animals of the world. He perfected the system of binomial nomenclature as applied to animals in the tenth edition of his *Systema Naturae* published in 1758. A uniform method of naming animals was thus inaugurated. Linnaeus is the founder of the subspecies of **TAXONOMY** and through his recognition and reliance upon valid characters for scientific classification, he did much to lay the foundations for the later development of the evolutionary concept in the 18th and 19th centuries. Linnaeus, however, conceived species as fixed and separately created, but he classified animals into

natural groups and even recognized the similarity of man to the other primates. The true significance of these similarities, however, seems never to have dawned upon him.

CUVIER (1769-1832) may be considered the founder of COMPARATIVE ANATOMY. His studies resulted in extending the concept of homology, particularly among vertebrate animals. His keenness and accurate knowledge enabled him to recognize the relationships of fossil vertebrates to the living forms he had studied. He clearly showed the occurrence of extinct types of animals. He was antagonistic to the current concepts of evolution, however, and explained the existence of former varied faunas by the theory that there had been several separate creations and cataclysmic destructions of life on the earth.

The work of Von Baer (1792-1876) laid the foundations for the modern scientific study of EMBRYOLOGY. He established the fact that adult organs and tissues are the result of specialization and modification of fundamental embryonic cell layers or "germ layers," now recognized as the ectoderm, endoderm and mesoderm, thus giving the key to an understanding of comparative ontogeny.

Cytology was the direct outgrowth of the establishment of the cell as the unit of organization in both plants and animals by Schleiden (1804-1881) and Schwann (1810-1882). The cell theory resulted in the emphasis of modern zoology upon the structure and physiology of the living cell substance (protoplasm).

Vague attempts at an understanding of the environmental adaptations of animals are found in Greek literature, but the modern attack on the problem was dependent upon the development of the concept of evolution and the factors bringing about the evolutionary changes of animals. LAMARCK (1744-1829) explained the adaptation of animals as the result of the inheritance of acquired characteristics resulting from the direct modification of the bodies of the animals by environmental influences and the needs of the organism. DARWIN (1809-1882), established the theory of evolution on a firm factual basis and his theory of natural selection raised the study of the environmental relationships of animals to a scientific plane, giving rise to the modern subsience of ECOLOGY. Darwin also pointed out the significance of the geographical distribution of animals and thus, together with WALLACE (1823-1913) founded the subsience of zoogeography.

MENDEL (1822-1884) had discovered the separate inheritance of unit characters in plants and published his results in 1864. Although Mendel's work was overlooked until 1900, his laws of inheritance, when reexamined by Bateson and others, marked the founding of the subsience of GENETICS. His laws were found equally applicable to animals, largely through the work of Castle and Morgan.

The 20th century has witnessed an ever-increasing application of the scientific method, accurate observation and instrumental measurement to the phenomena

of animal life. The faunas of the various continents have been collected and studied by the museums of the world; the university laboratories have been the seats of experimental observation of physiological phenomena; the medical schools have applied the principles of zoology to the study of the health of mankind, and government bureaus have applied the principles of zoology to the control of economically harmful species and the improvement of domesticated animals.

Probably the outstanding development of the 20th century is the increased knowledge of dynamic co-ordination mechanisms in animals and animal communities. The work in the fields of experimental MORPHOLOGY, experimental embryology, physiology, endocrinology, genetics, animal behavior, animal sociology and animal ecology all illustrate the concentration upon coordinating mechanisms of organisms and communities of organisms. The modern tendency is to study the organism as a whole and groups of organisms as units, but the major activities of zoologists still include the scientific exploration and description of faunas, and the origin and evolution of the various animal groups and their interrelationships.

THE SUBSCIENCES OF ZOOLOGY

As in the case with all the major sciences, specialized portions have arisen, have been named, and are recognized for convenience of classification and administration. These subsiences are in truth rather arbitrary divisions of the subject and no hard and fast lines of demarcation separate the various fields. Rather, it is becoming increasingly apparent that the borderline fields between the well-established subsiences are rich areas for observational and experimental inquiry. Advancement in one subsience is likely to be the stimulus for development in a related field and it may safely be said that important discoveries in any single subsience have wholesome effects upon the science as a whole. What is true of the subsiences of zoology is also true of the relationship of zoology to the biological sciences, physical sciences and social sciences.

The major subdivisions of zoology most often receiving separate recognition are as follows:

Taxonomy. The science of the classification of organisms. Not only does the taxonomist name and describe the various species and groups of animals, but he studies their phylogeny or racial evolution through comparisons of homologous characters, geographic distribution and habitat. Taxonomy thus forms the basis for comparative zoology and bibliographical reference. It is intimately associated with morphology, ecology, zoogeography and PALEONTOLOGY. Within recent years, a developing relation to physiology and genetics is becoming more apparent.

Morphology. The science of the structure of organisms. Morphology may be divided into the study of larger organ and tissue structures, usually considered the province of ANATOMY, and the study of microscopic structure of tissues and cells, usually considered the provinces of histology and cytology. To

a large extent, morphology is the foundation of taxonomy and paleontology, and coupled with the study of function, morphology shows close relationship to all other subsiences of zoology.

Physiology. Primarily, this is the study of function. In the usual sense of the term, however, this science is the study of the physico-chemical activity of living matter. In the last analysis, structure and activity of organisms seem to result from physico-chemical activities and interactions, thus making physiology basic to all the other subsiences of zoology. Certain properties of living organisms, however, have not yet been completely reduced to physiological terms, and to this extent some of the subsiences show less relation to physiology than others.

Animal Behavior. The science of animal psychology. This subsience might be considered as primarily a study of the function of the nervous system. It is thus a branch of physiology and shows close relationship to ecology and morphology.

Embryology. The science of the development of the individual or ontogeny. Usually embryology pertains to the study of embryos, organisms in early stages of development before becoming independent of the food stored in the egg or furnished through nutritive membranes by the mother. In the broad sense, however, embryology is conceived as the science of development and thus includes the changes in animals undergoing metamorphosis and the changes occurring during the development from youth to maturity. Embryology freely draws upon morphological and physiological technique.

Genetics. The science of heredity. This study has concentrated upon the mechanisms whereby individual traits are passed on to succeeding generations. In as much as the mechanisms are largely initiated through determiners in the nucleus of the germ cells or gametes, genetics has been closely associated with cytology. The material used consists largely of germinal variations, and genetics has been closely identified with the problems of the origin of variation and the physiology of reproduction. This emphasis brings this subsience into close contact with the study of evolutionary mechanisms.

Ecology. The science of the relationship of the organism to its environment. This study might be considered the physiology of the whole organism rather than the physiology of parts of the organism. It has to do with adjustments of a physico-chemical and biological nature between the animal and its surroundings. This subsience had its origins in the natural history of the 18th and 19th centuries, but in recent years has taken a prominent place among the experimental subsiences of zoology. It is closely related to physiology and zoogeography and its principles are interwoven with all the other subsiences.

Zoogeography. The geographical distribution of animals and its determining factors. The generalizations of zoogeography are of great importance to the ecologist and evolutionist. The principle of isolation has been important in an understanding of evolution

and brings zoogeography into close contact with genetics. Taxonomists, in their zeal for discovering and describing the kinds of animals from various parts of the world, have contributed most of the data of zoogeography and the subsience is still largely developed by natural history museums.

The establishment of the principle of evolution had considerable influence upon all branches of biology and is the noteworthy contribution of 19th century thought.

ANIMAL CLASSIFICATION

Man has already described and named almost one million different species of animals, and it is probable that this number represents less than half of the species that are in existence to-day. The paleontologist is also busily engaged in discovering and describing the remains of past faunas. These indicate tremendous variety in animal forms since their remote origin.

This vast horde is classified largely upon structures which are believed to have a common origin (homologous). Evolutionary concepts thus pervade and give significance to the similarities between animals.

Modern classification of animals is based upon the original Linnæan system, but with the improvements which have resulted from the greater knowledge which we now have. All animals are classified into groups of descending ranks designated as phylum, class, order, family, genus, species. Owing to the fact that these categories are somewhat arbitrary divisions based in part upon convenience, and owing to the evidence of a continuous evolution which is still operating, we might expect difficulty in drawing rigid lines separating the various ranks. This difficulty is largely overcome by inserting the prefixes *sub* or *super* when necessary and convenient. Thus we may classify the lion as follows:

Phylum, *Chordata*
Subphylum, *Craniata*
Class, *Mammalia*
Subclass, *Eutheria*
Order, *Carnivora*
Family, *Felidæ*
Genus, *Felis*
Species, *leo*

The scientific name is the combination of the generic and specific names, in this case *Felis leo*. Other species of the same genus would be named by changing the specific name: the tiger is *Felis tigris*, the leopard is *Felis pardus*, the puma is *Felis cougar*.

The genera are then grouped into families, for instance the cheetah, or hunting leopard, *Acinonyx jubatus* also belongs to the *Felidæ* or cat family. Families are then grouped into orders; for example the dog family (*Canidæ*) and the bear family (*Ursidæ*) belong with the *Felidæ* in the order *Carnivora* or flesh-eating mammals. Likewise the several orders of furred animals in which the young are born alive, such as the primates, elephants and bats, are grouped into the subclass *Eutheria*, the viviparous mammals. These in turn are grouped with the *Prototheria* or egg-laying

furred animals into the class *Mammalia* which includes all animals which nourish their young through secretions of the mammary glands. The *Mammalia* are similar to the *Aves* (birds) and *Reptilia* (reptiles) in possessing a bony or cartilaginous brain case. All such animals are included in the subphylum *Craniata*. Certain other animals which do not possess a skull share with the *Craniata* a supporting organ consisting of a hollow tube of cells, the notochord, often found only in the embryo. Animals possessing a notochord at some stage in their development are grouped into the phylum *Chordata*.

FUNDAMENTALS OF ORGANIZATION

It is highly important in the classification of animals to emphasize the characteristics which indicate fundamental plans of organization and which indicate evolutionary relationships. There are varying opinions among zoologists as to which characteristics are most important, but in classifying animals into their major groups or phyla, the following fundamental plans of organization are most often recognized. They have been arranged in approximately the order of evolutionary sequence.

UNICELLULAR ORGANIZATION. The whole individual animal consisting of a single cell. Cell protoplasm carries on a division of labor between parts, such as the nucleus and cytoplasm. The phylum *Protozoa* is the only group of animals which is unicellular.

MULTICELLULAR ORGANIZATION. Multicellularity is characteristic of all the phyla above the *Protozoa*. The colonial *Protozoa* are interesting forms which seem to illustrate the principles of evolution of the multicellular forms from unicellular types. There is a division of labor between the cells of the multicellular animal and mechanisms of coordination between the various specialized cells are apparent.

BLASTULA. The hollow sphere of cells is characteristic of certain colonial *Protozoa* and is found in the embryo or larva of all typical multicellular phyla.

RADIAL SYMMETRY. This type of symmetry is found in the *Porifera* and the *Cœlenterata*. An axis of differential specialization extends longitudinally through the body, and there is also differential specialization from the periphery to the center of the animal.

MANY PORES THROUGH WALLS. The *Porifera* (sponges) have many pores in the sides of the body through which water enters. A gastric epithelium captures the food particles in the currents of water passing through these pores. The water flows out through a large exit or osculum. This plan of organization is unique in the sponges.

ECTODERM AND ENDODERM. The cell layers resulting from gastrulation (invagination or inwandering of the cells of the blastula to form the digestive tract) are referred to as ectoderm (outside skin) and endoderm (inside skin). These layers are further differentiated into many specialized tissues in the *Cœlenterata* and higher animals. The cell layers in the *Porifera* do not seem to be homologous.

PLANULA LARVA. This is a free-swimming larva with the organization of the gastrula stage of higher animals. It is found only in the *Cœlenterata* and in a modified form in the *Ctenophora*.

NEMATOCYSTS. Specialized stinging organs found only in the *Cœlenterata*. It is impossible to say whether the ancestors of the higher animals possessed these structures or not. They may be special cells developed after the *Cœlenterata* became separated from the main branch.

NERVOUS SYSTEM. Nerve cells are distinguished in the *Cœlenterata* and are found in all higher animals. In the primitive condition they are not massed in ganglia, but form a nerve network surrounding the mouth.

CILIATED RIBS. The *Ctenophora* have eight bands of cilia used for locomotion. The ciliated ribs of the larvæ of the *Platyhelminthes* and *Nemertinea* are considered homologous, and it is possible that the ciliated bands of the trochophore larva are specializations of the condition found in the adult *Ctenophora*.

BIRADIAL SYMMETRY. Although the *Ctenophora* show unmistakable similarity to the *Cœlenterata*, they have made progress toward bilateral symmetry and represent the transition between radial and bilateral types. The higher *Cœlenterata* also often show a tendency toward biradial symmetry.

TRIPLOBLASTIC ORGANIZATION (MESODERM). In the higher *Cœlenterata* and *Ctenophora* the mesoglea is invaded by cells which form a connected tissue between the ectoderm and endoderm. This tissue is usually differentiated into muscle bands. There are different origins of the mesoderm, either through a budding of the endoderm or from special pole cells. Some authorities consider this different origin indicative of lack of homology and separate two main branches of phyla from the *Cœlenterata* on this basis (Wilson, Allee).

NERVE GANGLIA. Concentration of nerve cells into ganglia giving rise to a central nervous system is characteristic of the *Ctenophora* and all higher phyla.

CTENOPHORA-LIKE LARVA. Possessing ciliated ribs or lobes similar to the adult *Ctenophora*. No anus is present. Both Muller's larva found in the *Platyhelminthes* and the Pilidium larva of the *Nemertinea* show this type of organization. This type of larva is considered as possibly ancestral to the more specialized trochophore larva.

BILATERAL SYMMETRY. Characteristic of all phyla above the *Ctenophora*. In its primitive form, the *Platyhelminthes* are the best examples. Child has conducted experiments which indicate that this type of symmetry results from differential rates of metabolism in different parts of the body. The metabolic rate is higher in front than behind, thus forming the antero-posterior gradient. The ventral parts have higher rates than the corresponding dorsal parts, thus forming the ventro-dorsal gradient (dorso-ventral in the *Chordata*). The middle portions have higher rates than the side portions, thus forming the medio-lateral gradients. The results of differentiation along

these axes gives the bilateral type with a head where the animal first comes into contact with the environment, the two sides mirror images of each other and a ventral and dorsal differentiation. Some authorities doubt whether bilaterality is homologous throughout the animal series, but in the accompanying hypothetical tree, it is considered so.

FLAME CELLS. In the primitive condition, the excretory system consists of flame cells which excrete waste products into a central lumen, from which the fluids are driven by the beating of a group of cilia. Ducts lead the fluids to the outside. This type of excretory system is found in the *Platyhelminthes*, *Nemertinea*, *Trochelminthes*, *Mollusca*, *Annelida* and *Chordata*. It is probably the ancestral type, but many other modifications are to be found and other systems of disposing of liquid wastes seem to arise independently in the series, so that it is not possible to use all excretory systems as indicating relationships.

METAMERIC INDICATIONS. True segmentation or metamerism is not found in the lower phyla, but there are many indications of organization which might be conceived as forerunners of metamerism. Possibly the best, and by many considered significant in the origin of metamerism, is to be found in the *Platyhelminthes*. These flatworms have a tendency to produce repeated portions at the tail region through the formation of zooids. These zooids often separate from the parent and become independent individuals, but in some cases several may be found adherent in one individual.

BLOOD VASCULAR SYSTEM. There seem to be indications of a separate vascular system even in the *Platyhelminthes*, but the first true blood system with closed vessels appears in the *Nemertinea*. There are many modifications of this system in higher forms, and in some cases it is lost secondarily. It is not possible to be sure that in all cases it is homologous.

COELOM. A cavity in the mesoderm either arising by a hollowing process in the *Annelida-Arthropoda* branch or by an outpocketing of the archenteron in the *Chordata-Echinodermata* branch. It is usually lined with an epithelium called the peritoneum, but this is lacking in certain groups, notably in the *Nemathelminthes*. There is much difference of opinion among the authorities as to whether the coelom has a double origin. In the hypothetical family tree we have considered it homologous. In many groups the reproductive organs originate from the walls of the coelom, and this interesting fact suggested that the coelom is an enlargement of the gonad cavity.

TROCHOPHORE LARVA. Characterized by a band of cilia (prototroch) separating the animal into preoral and postoral regions. A mouth and anus are present. Mesoderm, muscles and flame cells are to be found, and an apical ganglion gives rise to a nerve ring around the mouth connecting with a ventral nervous system. This larva is surely homologous in the *Annelida* and *Mollusca*. Most authorities consider the larvæ of the *Brachiopoda*, *Bryozoa*, *Phoronidea*, *Sipunculoidea* and the adult *Trochelminthes* as trochophore types which are homologous and point to a

common ancestry of these phyla. The trochophore of the *Brachiopoda* shows points of resemblance to the dipleurula larva of the *Echinodermata* series.

LOPHOPHORE. Ciliated tentacles surrounding the mouth and forming the main feeding organ of the *Bryozoa*, *Phoronidea* and *Brachiopoda*. There is good evidence that this organ is homologous in these phyla.

CUTICULAR BODY COVERING. Columnar cells or hypodermis secrete a cuticle notably in the *Annelida*, *Arthropoda* and *Nemathelminthes*. In the *Arthropoda* this becomes a horny supporting structure known as the chitinous exoskeleton which is developed into plates or sclerites.

METAMERISM. Repetition of organismal units with similar organs along the antero-posterior axis. It is definitely characteristic of the *Chordata*, *Annelida* and *Arthropoda*, the *Chordata* having separately evolved this type of organization in all probability.

OPEN VASCULAR SYSTEM. The blood spaces are enlarged into a general cavity between the organs and tissues (hæmocoele) through which the blood flows. The blood enters the heart through openings (ostia) and is pumped forward, flowing into the anterior portion of the hæmocoele. This system is characteristic of the *Onychophora* and *Arthropoda*.

SIX-SEGMENTED HEAD. The *Arthropoda* all have heads composed of six segments. Groups such as the *Tardigrada*, *Pentastomida* and *Onychophora* do not have this type of head and are not true *Arthropoda* in spite of the fact that most authors include these groups in the *Arthropoda*.

COMPOUND EYE. Visual organ of many units (ommatidia or facets) found only in the *Arthropoda*. It may become modified into simple eyes or be reduced, but it is present in the most primitive forms and represents an ancestral character in the *Arthropoda*.

DIPLEURULA LARVA. A bilateral larva with coelom divided into three divisions. The middle division is prolonged into a ciliated lobe (lophophore?) for feeding. Bands of cilia and an anus derived from the blastopore are also characteristic of this larval type. The larvæ of the more primitive *Chordata* and *Echinodermata* are very similar, and most authorities now consider these as homologous, thus indicating a common descent of the *Echinodermata* and *Chordata*. Although such a relationship is indicated in the hypothetical tree, the ancestry of the *Chordata* still remains a great question, and facts which can be relied upon to indicate the origin of the *Chordata* are extremely few in number.

SECONDARY RADIAL SYMMETRY. Adult *Echinodermata* show tendencies toward bilaterality, and their larvæ are all bilateral. The indications are very convincing that the radial symmetry of this phylum is secondarily evolved from an original bilateral symmetry.

WATER VASCULAR SYSTEM. This is a specialization of the coelom well developed in the *Echinodermata* and serving the function of locomotion.

NOTOCHORD. A supporting organ found during some stage in all *Chordata*. In the higher forms it

appears only in the embryo, and later the cartilaginous or bony skeleton is formed around it.

PHARYNGEAL GILL CLEFTS. In the lower *Chordata* and *Craniata*, slits in the pharynx lead water taken into the mouth to the outside. As the water passes through these slits, it serves a respiratory function. In the terrestrial vertebrates these clefts appear only in the embryo or larva, and in the higher vertebrates they become wholly non-functional as respiratory mechanisms.

THE PHYLOGENETIC SYSTEM

The animal phyla are arranged primarily according to combinations of the various organismal characteristics in the previous discussion. Modern zoologists are consistent in the recognition of the major phyla of animals, but many of the smaller groups which show degenerate or highly specialized characteristics may be either recognized as separate phyla or included tentatively in other phyla. Following is an arrangement of phyla and classes which approximates the classification adopted by most of the modern authors.

- I. Phylum *PROTOZOA*. One-celled animals.
 - Class 1. *Mastigophora*. Protozoa with flagella.
 - Class 2. *Rhizopoda*. Protozoa with pseudopodia.
 - Class 3. *Sporozoa*. Parasitic protozoa usually without locomotor organs or mouth; reproducing by spores.
 - Class 4. *Infusoria*. Protozoa with cilia in adults.
 - Class 5. *Suctorina*. Protozoa with cilia confined to young stages; adults with projections for piercing and sucking.
- II. Phylum *PORIFERA* (sponges). Diploblastic; radially symmetrical; many pores in walls; skeleton of spicules or spongin; no oral region.
 - Class 1. *Calcarea*. Skeleton of carbonate of lime; spicules monaxon or tetraxon in form.
 - Class 2. *Hexactinellida*. Skeleton of silicon; spicules triaxon.
 - Class 3. *Demospongiae*. Siliceous or spongin skeletons; spicules if present not triaxon.
- III. Phylum *COELENTERATA* (jellyfishes, polyps, corals). Diploblastic; ectoderm and endoderm; oral region; gastrovascular cavity; tentacles; nematocysts; radial symmetry; differentiated nerve cells.
 - Class 1. *Hydrozoa* (polyps, small jellyfishes and a few stony corals). Without stomodæum or mesenteries; eggs and sperm discharged to the exterior; hydroid (polyp) and medusa (jellyfish) forms often in the life history of the same species; medusæ always with a velum.
 - Class 2. *Scyphozoa* (larger jellyfishes). Without conspicuous polyp stage in life history; medusæ usually without velum; margin of umbrella notched.
 - Class 3. *Anthozoa* (sea anemones, sea pens and most stony corals). Possessing stomodæum (inturned ectodermal gullet) and mesenteries (vertical partitions of gastrovascular cavity); without medusa stage.

IV. Phylum *CTENOPHORA* (comb-jellies). Triploblastic; biradial symmetry; nerve ganglia; ciliated ribs arranged in eight rows; nematocysts absent.

Class 1. *Tentaculata*. Usually with two aboral tentacles.

Class 2. *Nuda*. No tentacles or oral lobes.

V. Phylum *PLATYHELMINTHES* (flatworms). Bilaterally symmetrical; triploblastic; anus absent; usually with gastrovascular cavity; flame cells; coelom lacking; mesoderm from pole cells.

Class 1. *Turbellaria*. Free-living; ciliated.

Class 2. *Trematoda* (flukes). Parasitic; without cilia; with digestive tract; with suckers.

Class 3. *Cestoda* (tapeworms). Parasitic; without digestive tract; without cilia; with attachment region (scolex) and a chain of similar individuals (proglottides) resulting from transverse budding.

VI. Phylum *MESOOZOA*. Degenerate multicellular parasites; probably with only ectoderm and endoderm. Generally considered as derived from a *Platyhelminthes*-like ancestor which was bilaterally symmetrical and triploblastic.

Class 1. *Rhombozoa*. With a central cell giving rise to reproductive cells and surrounded by ectodermal cells not arranged in rings.

Class 2. *Orthonectida*. With central mass of reproductive cells surrounded by ectodermal layer arranged in rings. Muscle fibrils between the outer and inner cells.

VII. Phylum *NEMERTINEA*. Bilaterally symmetrical; triploblastic; possessing anus; blood-vascular system; proboscis; proboscis sheath; cilia; flame cells; no developed coelom present.

Class 1. *Nemertina*. Same characteristics as phylum.

VIII. Phylum *NEMATHELMINTHES* (round worms). Elongated round worms; unsegmented; coelom without peritoneum; mesoderm from pole cells; mouth from blastopore; without trochophore stage; noncellular cuticle covering body; digestive tract present; lateral lines along sides of body; with anus.

Class 1. *Nematoda*. Same characteristics as phylum.

IX. Phylum *NEMATOMORPHA* (hair worms). Unsegmented worms; coelom with peritoneum; no lateral lines; without trochophore; noncellular cuticle covering body; with anus; nerve ring connecting dorsal ganglia with ventral nerve cord.

Class 1. *Gordiacea*. Same characteristics as phylum.

X. Phylum *ACANTHOCEPHALA*. Elongated, parasitic worms; attachment by means of retractile proboscis armed with hook-like spines; digestive tract absent; noncellular cuticle covering body.

Class 1. *Acanthocephala*. Same characteristics as phylum.

XI. Phylum *TROCHELMINTHES* (wheel animalcules, etc.). Bilaterally symmetrical; triploblastic; mouth; anus; flame cells; usually with cilia; coelom degenerate or absent; nerve ring around mouth; ventral nervous system.

Class 1. *Rotifera*. Trochophore-like adult with one or two bands of cilia; pharyngeal crushing apparatus present.

Class 2. *Gastrotricha*. Two rows of cilia on ventral surface; body flattened; cuticular spines on back. The relationship to the rotifers is not clear.

Class 3. *Kinorhyncha*. Without cilia; body composed of a series of rings; hooks around the mouth. Affinities with the *Gastrotricha* and *Rotifera* are not clear.

XII. Phylum *BRYOZOA* (moss animals). Sessile animals; usually colonial; bilaterally symmetrical; trochophore larva; lophophore; anus; mesoderm from pole cells; coelom formed through hollowing process when present.

Class 1. *Endoprocta*. Anus within the lophophore; coelom absent.

Class 2. *Ectoprocta*. Anus outside the lophophore; coelom present.

XIII. Phylum *PHORONIDEA*. Sessile marine animals in tubes of chitin; gregarious but not colonial; bilaterally symmetrical; modified trochophore larva; lophophore; anus; mesoderm from pole cells; coelom formed through hollowing.

Class 1. *Phoronida*. Same characteristics as the phylum.

XIV. Phylum *MOLLUSCA*. Bilaterally symmetrical; trochophore larva; anus; mantle; usually with shell; ventral muscular foot, in a few cases modified into arms; mesoderm from pole cells; coelom formed through hollowing; flame cells in early stages.

Class 1. *Amphineura*. Shell composed of eight transverse plates; head absent.

Class 2. *Pelecypoda*. Without head; shell composed of right and left valves.

Class 3. *Scaphopoda*. Shell tubular, open at each end; head absent.

Class 4. *Gastropoda*. Usually with single coiled shell; head present with one or two pairs of tentacles.

Class 5. *Cephalopoda*. Head with long arms.

XV. Phylum *SIPUNCULOIDEA*. Unsegmented marine worms with trochophore larva; anus; mesoderm from pole cells; coelom hollowed; without cilia in adult.

Class 1. *Sipunculida*. Body elongated; tentacles usually present.

Class 2. *Priapulida*. Body robust; no tentacles.

XVI. Phylum *TARDIGRADA* (bear animalcules). Segmented; coelom degenerate; four pairs of clawed legs probably homologous to chaetopod setae; antennae and mouth appendages lacking; no special circulatory or respiratory organs present; reproduc-

tive organs opening into the intestine; no trochophore larva; nervous system consists of brain and four pairs of ventral ganglia.

Class 1. *Tardigrada*. Same characteristics as the phylum.

XVII. Phylum *ANNELIDA*. Segmented worms with mesoderm derived from pole cells; coelom hollowed; trochophore larva; ventral nervous system; bilateral symmetry; larvae with flame cells.

Class 1. *Echiurida*. Segments poorly developed; setae present.

Class 2. *Archannelida*. Segmented marine worms with no setae or parapodia.

Class 3. *Chaetopoda*. Numerous segments with setae; ventral chain of ganglia; blood vascular system.

Class 4. *Hirudinea* (leeches). Usually with 34 segments and 1 or 2 suckers.

XVIII. Phylum *ONYCHOPHORA*. Internally segmented; with tracheal respiratory system; legs on each body segment armed with claws but not distinctly jointed; head with ringed antennae; haemocoel and paired ostia in heart; head composed of three segments; without striated muscle, compound eyes or chitinous exoskeleton; coelom reduced.

Class 1. *Onychophora*. Same characteristics as phylum.

XIX. Phylum *PENTASTOMIDA*. Wormlike parasites; segmented; two pairs of hooks near mouth; larvae with two pair of unjointed legs; no circulatory or respiratory organs; male reproductive organs open a short distance behind the mouth; female reproductive organs open at the caudal end; nervous system of the *Annelida-Arthropoda* type; striated muscle; chitinous cuticle.

Class 1. *Linguatulida*. Same characteristics as the phylum.

XX. Phylum *ARTHROPODA*. Segmented; bilaterally symmetrical; chitinous exoskeleton; jointed chitinous legs; striated muscle; compound eyes; reduced coelom; six-segmented head.

Class 1. *Palaeostracha*. Without antennae; cephalothorax composed of 9 segments; abdomen composed of 12 segments which are fused in living species; marine with blood gill-books; reproductive organs opening on first abdominal segment; posterior appendages of cephalothorax not fused.

Class 2. *Arachnida*. Air-breathing, terrestrial arthropods without antennae; typically with four pair of walking legs; body divided into cephalothorax and abdomen.

Class 3. *Pycnogonida*. Marine arthropods without antennae; abdomen reduced.

Class 4. *Crustacea*. Two pairs of antennae; mandibles on fourth head segment; usually aquatic with blood gills.

Class 5. *Diplopoda* (millipedes). Tracheate, terrestrial arthropods with mandibles on fourth

head segment; two pairs of legs on most body segments; one pair of unbranched antennæ.

Class 6. *Paupoda*. Tracheate, terrestrial arthropods with mandibles on fourth head segment; eyes lacking; antennæ branched.

Class 7. *Symphyla*. Tracheate, terrestrial arthropods with mandibles on fourth head segment; two pairs of maxillæ; Y-suture on head; legs grouped into double pairs.

Class 8. *Chilopoda*. Tracheate, terrestrial arthropods with mandibles on fourth segment; two pair of maxillæ; pairs of legs not arranged in double pairs.

Class 9. *Insecta*. Tracheate; mandibles on fourth segment; maxillæ on fifth head segment; labium on sixth head segment; three pair of thoracic legs; abdomen without functional legs in adult.

XXI. Phylum *BRACHIOPODA* (lamp shells). Bilateral symmetry; dorsal and ventral shells; lophophore; mouth from region of blastopore; cœlom formed by outpocketing of digestive tract; modified trochophore larva; anus present in most forms. Allied to the *Bryozoa*.

Class 1. *Brachiopoda*. Same characteristics as phylum.

XXII. Phylum *CHÆTOGNATHA* (arrow worms). Bilaterally symmetrical; cœlom formed by outpocketing of digestive tract; no trochophore larva; peritoneum present; anus from region of blastopore; without notochord.

Class 1. *Chætognatha*. Same characteristics as phylum.

XXIII. Phylum *ECHINODERMATA*. Secondly radially symmetrical; water-vascular system present; anus derived from blastopore; cœlom formed by outpocketing of digestive tract; dipleurula larva; calcareous plates in body wall.

Subphylum *ELEUTHEROZOA*. Echinoderms without a stalk.

Class 1. *Asteroidea*. Five radiating arms from disc; arms not sharply set off from disc; tube feet in grooves on oral surface.

Class 2. *Ophiuroidea*. Five radiating arms set off sharply from disc; tube feet not in grooves.

Class 3. *Echinoidea*. No arms; rigid joined plates; globe- or disc-shaped.

Class 4. *Holothuroidea*. No continuous skeleton; plates small; elongated and cylindrical; mouth surrounded by a circle of tentacles.

Subphylum *PELMATOZOA*. Echinoderms with stalks.

Class 5. *Crinoidea*. Five feathery arms attached to a cup-like disc temporarily or permanently attached by a stalk.

XXIV. Phylum *CHORDATA*. Notochord at some stage in development; paired pharyngeal gill clefts at some stage in development; tubular dorsal nervous system; flame cells in some primitive types; dipleurula larva in some primitive types; bilaterally

symmetrical; mesoderm and cœlom formed by outpocketing of digestive tract; anus from region of blastopore.

Subphylum *HEMICHORDATA*. Wormlike body; body composed of three portions, the proboscis, the collar and the trunk.

Class 1. *Enteropneusta*. Same characteristics as the subphylum.

Subphylum *UROCHORDATA*. Body more or less sac-shaped; notochord confined to temporary tail of larva; body covered by cellulose tunic secreted from underlying epidermal cells.

Class 2. *Tunicata*. Same characteristics as subphylum.

Subphylum *CEPHALOCHORDATA*. Body lanceolate; fish-like forms; permanent notochord extending from end to end.

Class 3. *Leptocardia*. Same characteristics as subphylum.

Subphylum *CRANIATA* (vertebrates). Cranium or brain case present; usually with well-developed series of neural arches or vertebræ extending along the dorsal axis.

Class 4. *Cyclostomata* (lampreys and hagfishes). Notochord persists as the skeletal axis of the adult; without jaws or paired fins.

Class 5. *Elasmobranchii* (sharks, rays, skates and chimæras). Notochord persisting in adult; jaws; placoid scales; paired fins; no air bladder.

Class 6. *Pisces* (true fishes). Notochord not persisting in adult; air bladder or lung; paired fins; without placoid scales; usually with scales or plates; breathing chiefly by gills; two chambered heart.

Class 7. *Amphibia*. With gills during larval life and lungs in adult; scales usually absent; heart three-chambered; with four legs adjusted for locomotion on ground (in a few cases these have been lost).

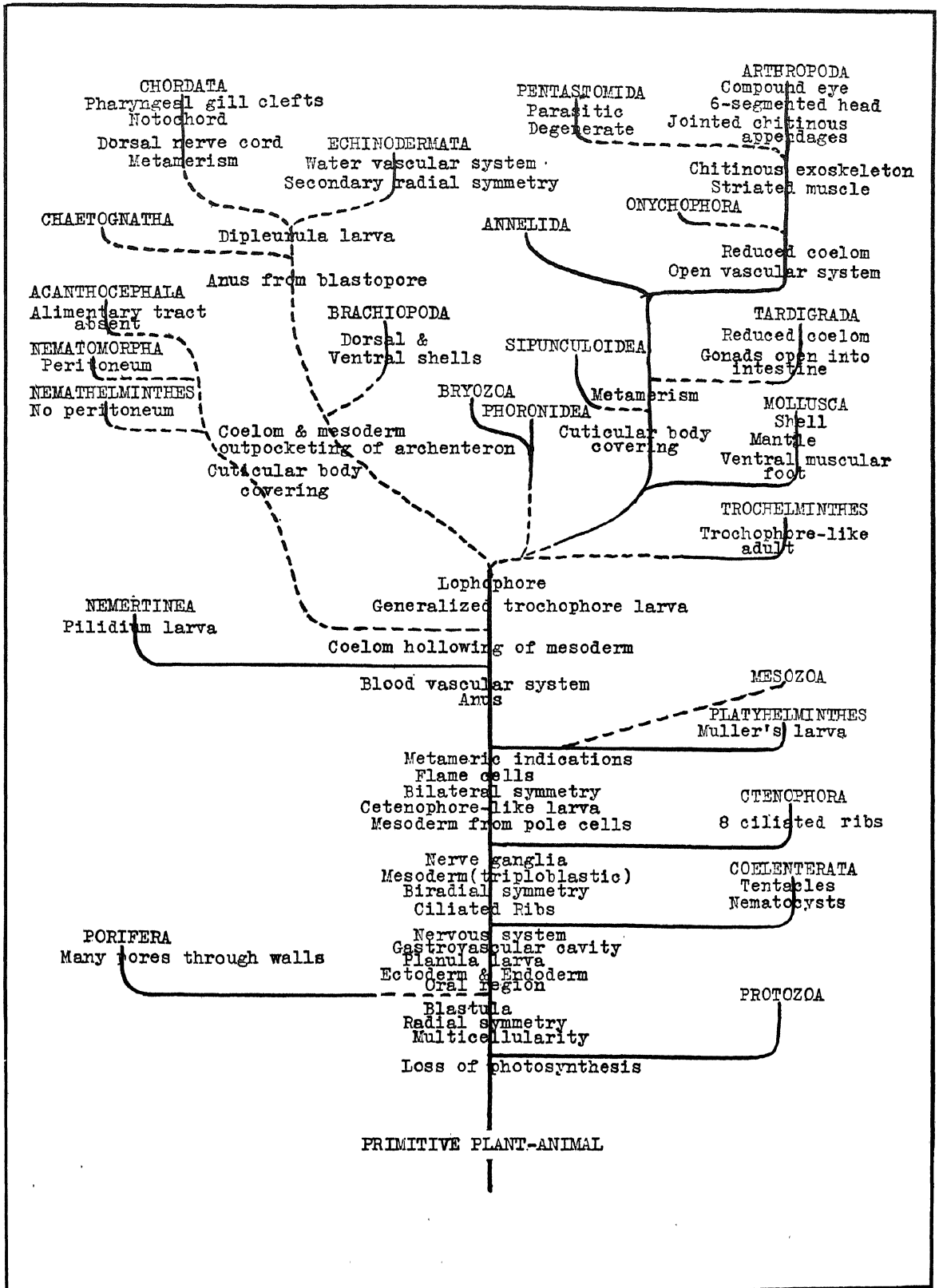
Class 8. *Reptilia*. Cold-blooded; usually with scaly skin; breathing by means of lungs; usually hatched from land egg; without functional gills; three-chambered heart.

Class 9. *Aves* (birds). Warm-blooded; lungs; four-chambered heart; wings; feathers.

Class 10. *Mammalia* (mammals). Warm-blooded; hair; four-chambered heart; mammary glands; muscular diaphragm separating the chest and abdomen.

PHYLOGENETIC RELATIONSHIPS

An attempt is made to place the animal phyla in an orderly sequence on the basis of characters generally considered homologous. The characters are inserted in their theoretical place of origin. Such a tree serves a purpose in visualizing the relationships of the larger animal groups. At the same time, so many of the relationships are so imperfectly known that any such arrangement is not wholly satisfactory and opinions of leading zoologists differ concerning many of the significant indications of evolutionary



history. The doubtful relationships are indicated by dashed lines and the better understood relationships are indicated by a solid line. A. E. EM.

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ZORACH, WILLIAM (1888-), American sculptor, was born in Euberick, Russia, Feb. 28, 1888. His parents brought him to America at the age of four and settled in Cleveland, O. He studied in the Cleveland School of Art and later in New York and Paris. Zorach was first known as a painter, and was one of the pioneer moderns in this country. He has exhibited both in Paris and America, and his work is represented in many museums and private collections. In 1916 Zorach carved his first figure in wood and within the next few years became so absorbed in sculpture that he devoted all his time and thought to it. He is known especially for his heads and torsos in marble and granite and for his figures and bas-reliefs carved in wood. His most important work is a monumental group of a Mother and Child carved directly by the sculptor himself out of a huge block of Spanish marble. His work is characterized by a great simplicity of form, the interrelated rhythms of spaces and volumes, and a deep emotional quality. Zorach achieves life and expression by purely sculptural means. While modern in spirit and form his work is in accord with the traditions of art.

ZORN, ANDERS (1860-1920), Swedish painter and etcher, was born at Mora, in Dalecarlia, Sweden, Feb. 18, 1860. As a boy he showed skill as a wood-carver, after which he gained reputation as a water-colorist and painter. He visited the United States seven times and executed oil paintings of Roosevelt, Taft and John Hay. In London he studied etching with Axel Herman Haig and rapidly developed a highly individual technique. Although best known for his etchings of nude young women, which in their robust healthiness are typical of the Scandinavian tradition, Zorn's outstanding plate is the portrait of *Renan*. His bold, strong lineation and juxtaposition of heavy masses of black and white, which give his work an effect of light and color, have been much imitated but not equalled. Zorn died at Mora, Aug. 22, 1920.

ZOROASTRIANISM, the religion of Zoroaster (Zarathustra) and his followers, known to-day in Persia as Gebers, and in India as Parsis. Zoroaster (660-583 B.C.) belonged to the noble family of Spitama, of northwest Persia (Iran). Only fragments of his authentic life-story are preserved. The most that we know of him is found in the songs called Gathas, the oldest portions of the sacred Avesta. His Gathic portrait shows him a stirring individuality, a man of holy zeal, a prophet and teacher of unquestionable

power. He is the first personal founder (except Moses) of a thorough-going system of religion. He himself was an "Aryan" (Indo-European) amidst Turanian, Semitic, and other environmental elements. In Media there was "Magianism," a system of nature-worship with its wise men (magi). He set himself to reform the situation and found himself in strife with the various leaders of the medley of faiths.

Zoroaster was the prophet of Ahura Mazda, "Lord of Wisdom," who had called him to his holy task. (See AHURA MAZDA.) He did not deny the nature-spirits, but he cared alone for Ahura Mazda whose manifestations (inner qualities) are good mind, right order, truth, purity, power and immortality. He thought of heaven and hell as mental states; he proclaimed that God's kingdom was within you; he taught that the world and man's own soul are fields of battle between good and evil, and that the good will eventually win the day. To Zoroaster the chosen people of Ahura Mazda are those who individually make their wills conform with God's, and who give themselves to true faith, practical religion and public service. Man's welfare lies in his own power as an ally of truth, and in the final triumph of Ahura Mazda.

Zoroaster recognized the actuality of evil in his times, but considered it as something psychological and ethical—that which men chose in opposition to the good. His followers elaborated the good-evil opposition into two great camps of men, allied, on the one hand with Mazda, and, on the other hand, with Ahriman, the Devil. In this way the prophet's "evil mind" (*angra mainyu*) and "lie" (*druj*) became personified into a personal Devil. Likewise, the attributes of Mazda become by development a corps of angels—with a host of demons in array against them. The faith, nevertheless, has remained a practical monotheism, for it is held that at last the good will be victorious, with Mazda and good men alone in the Land of Bliss. Modern Zoroastrians of the progressive type (see PARSIS) are eager to restore the faith to its high ethical level of good thoughts, good words and good deeds, and to urge upon the prophet's followers their full co-operation with Ahura Mazda (Ormazd) in the practical affairs of life.

J. C. A.

ZORRILLA DE SAN MARTIN, JUAN (1855-), the dean of Uruguayan letters, was born Dec. 28, 1855, in Montevideo, and was educated in Argentina, Uruguay and Chile. He took the degree of Advocate at the University of Chile, Santiago, in 1877, and returned to his native city, there to engage in a juridical career. He took part in the Revolution of Quebracho in 1885, and following this went into national politics, being elected Deputy for the years 1887-90. From this time on he represented his country on many diplomatic missions, serving as Minister Plenipotentiary to Madrid, as President of the Commission from Uruguay at the American Historical Exposition, as similar representative in Paris, 1894, and as Minister Plenipotentiary to the Holy See, 1898.

His chief title to fame rests upon his poem *Tabare*, published in 1888, and reprinted many times since then; it has been translated into Italian and also adapted to the cinema. In 1877 Zorrilla founded *El bien publico*, a Catholic organ. His first poems were issued in Santiago, Chile, in 1876; *La leyenda patria* appeared in 1879. Besides books of travel and speeches, he has published *La epopeya de Artigas*, 1910, and *La profecia de Ezequiel*, 1921; the former is a poetical biography of a great national figure, and the latter was suggested by the World War. *Tabare* is regarded as the outstanding masterpiece of Uruguayan poetry; the titular hero is a half-breed Charrua Indian who falls in love with Blanca, the sister of the Spanish commander; Tabare saves her from the chief of his tribe, but is slain by the commander, who mistakenly sees in Tabare the abductor of Blanca. *La leyenda patria*, a patriotic tribute to Uruguay, has been a source of inspiration to the national declaimers.

I. G.

ZORRILLA Y MORAL, JOSÉ (1817-93), Spanish poet, was born at Valladolid, Feb. 21, 1817. His various political adventures, for which he was eminently unsuited, and the poverty which ruined so much of his life, driving him to Mexico, whence he returned as poor as he went, undoubtedly injured his poetic work. Yet his lyric poems, imbued with courage, patriotism and religion, occupy a high place in 19th century Spanish literature. His dramas, especially *Don Juan Tenorio*, 1844, though highly censored, are effective and full of vigor. Zorrilla died at Madrid, Jan. 23, 1893.

ZOSIMUS, ST. (?-418), Pope of Rome, was elected Mar. 18, 417. Little is known of him before this date, except that he was a Greek. Because his father's name was Abram, he is thought by some to have been a Jew. His extant writings are chiefly letters dealing with doctrinal disputes concerning Pelagianism and Priscillianism, and with questions pertaining to the powers of the clergy. He died at Rome on Dec. 27, 418, and was buried in the sepulchral church of St. Laurence in Agro Verano.

ZOUAVES, the name for a body of soldiers in the French army, formed in 1830 and chiefly composed of native Algerian tribesmen. They have become noted for their bravery in many engagements. Several contingents of Union troops in the American Civil War adopted the name of Zouaves.

ZSIGSMONDY, RICHARD (1865-1929), Austrian chemist, was born at Vienna, Apr. 1, 1865. In 1908 he became professor of chemistry at Göttingen where his work upon colloids, ultra-microscopic problems and ultra-fine filtrates earned him the Nobel Prize in chemistry in 1925. He wrote *Colloid Chemistry*, 1912. He died at Göttingen, Sept. 23, 1929.

ZUEBLIN, CHARLES (1866-1924), American sociologist, was born at Pendleton, Ind., May 4, 1866. After studying at Northwestern, Yale and Leipzig universities, he founded in 1891 the Northwestern University Settlement at Chicago, Ill., with one of the most complete unit of settlement buildings in the

United States. His next undertaking was the establishment in 1892 of the Chicago Society for University Extension, which originated the university extension work at the University of Chicago, where he held the chair of sociology from 1902 to 1908. He was also known as lecturer and writer on civic duties. Among his publications are *A Decade of Civic Development*, 1905, and *Democracy and the Overman*, 1911. He died at Winchester, Mass., Sept. 15, 1924.

ZUIDER ZEE, an oval shallow gulf extending southward into the northwestern Netherlands, about 80 mi. long, with a maximum width of 45 mi., and separated from the North Sea by the Islands Texel, Vlieland, Terschelling, Ameland, and others. The entrances are guarded by modern defences. In 1918 the Dutch parliament passed a measure providing for partial drainage of the Zuider Zee to permit reclamation of 523,000 acres. Work on the project, which will cost 16,250,000 florins, began in 1924, and was expected to require 15 years. The first undertaking in the project was construction of a gigantic dam, 15 mi. long, between the island of Wieringen and the Friesland mainland.

ZULOAGA, IGNACIO (1870-), Spanish painter, was born at Eibar, in the Basque Province, July 26, 1870. He studied at Rome and at Paris; after a short stay in England he returned to Spain, settling at Seville. Recognition of his talents came slowly. As he founded his art on that of the great masters of his country, he developed a literal, rigorous style that was offensive to his compatriots, used to the cleverness and glitter of 19th century Spanish painting. Consequently Zuloaga has had to go as far afield as Brussels, Venice, New York and South America to find appreciation.

ZULULAND, a country of south Africa, formerly a native kingdom, but now forming part of the province of NATAL, Union of South Africa, to which it was annexed in 1897. The area covers 10,427 sq. mi. and stretches north from the Tugela River to the southern frontier of Mozambique. Eshowe, 95 mi. northeast of Durban, is the principal town. The Zulus, or Kaffir tribes, continue the tribal system and maintain a strong sense of nationality. Although herdsmen for the most part, they cultivate millet, maize, tobacco and sweet potatoes. Coastal forests consist of almost impenetrable undergrowth, and contain palms, mangroves and other tropical plants. In the upland regions are found yellow- and iron-wood. The lion, elephant, panther, zebra,gnu and buffalo are the principal wild animals of the region. A dwarf breed of humped cattle is the Zululand domestic animal. Pop. 1921, 250,829, including 3,985 white inhabitants.

ZULUS, a Negro people of Bantu stock comprising more than 100 small tribes and living in South Africa. The Zulu warriors are above average height and have splendid physiques. Their skin is a dark chocolate color and their features of the usual Negro type, with broad flat noses, high cheek bones, and thick fleshy lips. Their beehive-shaped dwellings are large structures made of thatch and plaster on a frame-

work of poles. These huts are built in a circle, and the cattle are kept in the center enclosure. Cattle-breeding and the raising of millet are their chief means of livelihood. Native industries include tanning of hides, iron smelting and basketry.

The Zulus probably first arrived in the region now known as Zululand in the beginning of the 17th century. Their settlements were on the White Umfolosi River, and the tribes were small and comparatively insignificant. In the 18th century under a series of mighty chiefs they increased in power and prestige, and under Chaka, the uncle of Cetewayo, a formidable army was organized along European lines. The Zulus menaced both Dutch and British until in 1879 when the British defeated Cetewayo, who had amassed an army of 40,000, and brought an end to the Zulu War. The Zulus have continued to be an important native element in South Africa.

ZUÑI, the largest of the Pueblo Indian villages, located on the Zuñi River near the western border of New Mexico and 40 mi. south of Gallup. The present village is all that remains of the seven towns, the famous "Seven Cities of Cibola" first seen by Niza in 1539 and entered by Coronado in 1540. A Spanish mission was established in 1629 by Franciscans, who gained considerable influence with the Indians, but in



ZUÑI WOMAN SHAPING CLAY DISC FOR THE BOTTOM OF A POTTERY BOWL

1632 the missionary was murdered and the Indians fled to their stronghold on Taaiyalone mesa, where they remained until 1635. The Zuñi Indians took part in the Pueblo Revolt in 1686, again murdering their missionary and fleeing to Taaiyalone. In 1692 they returned and built an entirely new pueblo, the present Zuñi, chiefly on the site of the village Hanlona, one of the "Seven Cities." The Zuñi have never taken kindly to missionaries and Christianity, but cling steadfastly to their aboriginal religion, customs, and ceremonies. Next to the Hopi they are considered the most typical of the Pueblo tribes. They are a peaceful agricultural people, skillful as weavers, silver-smiths and makers of pottery. Pop. 1930, 1,736.

ZUNZ, LEOPOLD (1794-1886), pioneer in the modern study of Jewish literature, born at Detmold, Germany, Aug. 10, 1794. His early religious and secular education he received in the schools of Wolfenbüttel. He studied at the University of Berlin, re-

ceived his doctor's degree from the University of Halle (1821). His essay entitled *Etwas über die Rabbinische Litteratur*, etc. (1817) was a remarkable plea for the recognition of Jewish lore and literature as worthy of academic attention. In the *Zeitschrift für die Wissenschaft des Judenthums* which he edited in 1822, he furnished the program for the new Jewish learning. It was to comprise a study of the historical development and the philosophical essence of Judaism based on a critical understanding of Jewish lore and letters.

Zunz's literary activity, embracing a period of more than half a century (1817-75) concerned itself primarily with the history and development of Jewish theological and ethical writings; the study of Jewish liturgy and medieval Jewish hymnology and with Jewish rites and ceremonies and of their life during the middle ages. His *Gottesdienstliche Vorträge der Juden* (1832) is certainly one of the most important Jewish works of the nineteenth century. It had a powerful influence in molding and shaping the methods of the modern study of Jewish life and literature. In his other publications which were likewise of great importance as well as in his scattered essays, Zunz delved into the study of subjects considerably neglected in the past. He was also active in public affairs, both religious and communal. He lived to see his ninetieth birthday celebrated by his coreligionists throughout the world, and it was commemorated by the publication of a *Zunz Jubelschrift*.

He died in Berlin on March 18, 1886. J. BL.

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ZURBARAN, FRANCISCO DE (1598- c. 1662), Spanish naturalist painter, was born at Fuente de Cantos, in Extremadura, in 1598. He attended the school of Juan de Roelas in Seville, where he soon became the star pupil. Zurbaran rapidly achieved a reputation in Seville. His skill in handling white draperies and his flair for ascetic subjects led to many commissions from Carthusian monasteries. His vigorous portraits of saints and priests are solidly rendered in planes and tones which meet without transitions and which cut each other brutally. The color usually has a bluish tone and the effect is more solid and striking than harmonious. Zurbaran is well represented in Seville. His largest composition, the former altar-piece entitled *The Apotheosis of St. Thomas Aquinas*, in which the important figures are over life size, is now in the Seville Museum; also at Seville, in the Church of St. Paul is the famous *Crucified Saviour*, in the Cathedral the screen of *St. Peter Nolasco* and in the Church of the Guadalupe several large pictures. About 1630 Zurbaran became court painter to Philip IV. He is believed to have died at Madrid in 1662.

ZÜRICH, capital of the canton of the same name, largest and most important city in Switzerland, on the north end of Lake Zürich and on both banks of the Limmat River. Lake dwellings prove a settlement on the site in prehistoric times. In 58 B.C. the Turi-

cum of the Romans arose on the Lindenhof from Celtic fortifications. This was replaced by the imperial residence of the Carolingians, to whose favor Zürich owes its prominence in medieval times. An imperial city in 1218, it united with Uri and Schwyz about 1292. Since 1351 a member of the Swiss Confederation, it has always stood at the head of Switzerland's intellectual life. The Swiss Reformation began there under Zwingli and in the following centuries it has had a long list of prominent men. Its excellent schools are headed by the university and the technological institute. Zürich is the center of the trade of eastern Switzerland and of the silk goods industry. Its cotton goods, machinery and foundries are also important. Noteworthy among the buildings are the Great Minster, a simple Romanesque basilica of the 12th and 13th centuries, the Gothic Minster of Our Lady, 13th century, St. Peter's Church, the cantonal library, Renaissance Rathaus, museum with unique collections and an art gallery. Pop. 1930, 249,130.

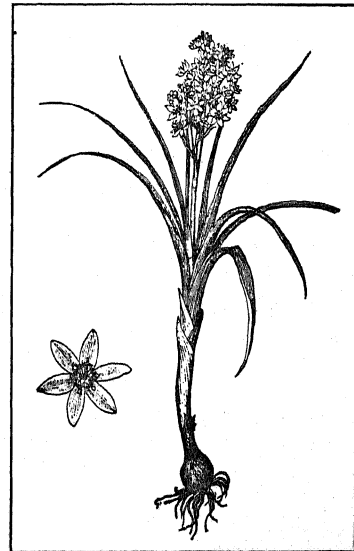
ZÜRICH, LAKE OF, in northern Switzerland, 1,342 feet above sea-level, in the southern part of the canton of Zürich, and bordering the cantons of Scawyz and St. Gall on the southeast. It occupies an area of 34 sq. mi., having a length of 25 mi., maximum breadth of 2½ mi. and an extreme depth of about 470 ft. Through the Linth Canal, it receives the waters of the Walensee at its southeastern extremity. There is an upper lake stretching from Schmerikon to Rapperswil, and a lower lake, from Rapperswil to Zürich, at which point its waters are expelled through the Limmat. A stone dam, supporting the highway and railroad between Pfäfikon and Rapperswil, isolates the remote east extremity of Lake Zürich, which is navigable only by vessels of shallow draft. Stafa, Meilen and Rapperswil are on the east bank, with Horgen, Thalwil, Wädenswil, Richterswil, Pfäfikon and Luchen situated on the west side and Zürich on the northern end. Although lacking the magnificence of many Swiss lakes, Zürich has a rural charm provided by a setting of undulating hills.

ZWICKAU, a German city in Saxony about 40 mi. south of Leipzig. Its older part has quaint buildings on crooked streets. The Gothic church, built about 1450, is notable on account of its statues dating from 1118, its huge bell and pictures by Lucas von Cranach. The Rathaus, 1581, preserves the archives kept since the 13th century, and other rare and valuable relics. Luther and Melancthon spent some time in Zwickau and it is the birthplace of Robert Schumann the composer. The Zwickau Anabaptist, Thomas Münzer, brought on the peasant war in Saxony, Franconia and Thuringia in 1525. A Slavic settlement originally flourished after the year 1000, as it lay on a trade route from Halle to Bohemia, and developed further after the discovery of the Schneeberg silver mines in 1479. Zwickau has important coal mining, machine, textile and other factories. Trade is active, particularly in grain, coal and linen. Pop. 1925, 80,358.

ZWINGLI, ULRICH (1484-1531), Swiss reformer and a founder of the REFORMED CHURCH,

was born at Wildhaus, St. Gall, Switzerland, Jan. 1, 1484. After his education at Berne, Vienna and Basle he was parish priest at Glarus, 1506, and served as chaplain to the young men recruited there for various European armies. He was appointed to the pastorate of Einsiedeln, 1516, and of Zürich, 1518. Here he began to preach in accordance with Luther's (see LUTHER, MARTIN) ideas, though his reforms were essentially his own. Finally, in 1523, his 67 theses were accepted by the Council of the canton of Zürich, thus inaugurating the REFORMATION in Switzerland, a movement which differed in many doctrinal points from that of Luther in Germany. In 1531 Zwingli was chaplain with the Zürich forces fighting the five Forest Cantons, which had not accepted the Reformation. He was killed in the Battle of Kappel, Oct. 11, 1531. His principal works are *De Vera et Falsa Religione* and *Fidei Ratio*.

ZWOLLE, capital of the Dutch province of Overijssel, located on the Zwarte Water, having steamer service to Kampen and AMSTERDAM. Zwolle has a Gothic gate with four towers and eight churches, among them the Reformed St. Michael containing an organ of renown. The city hall is a 15th century building. It has iron foundries and shipbuilding yards. The products manufactured are chemicals, liqueur, and mineral water. There are important grain, cattle and fish markets where active trade is carried on. Near by is the Agnietenberg, a former monastery where St. Thomas à Kempis lived. Zwolle received a municipal charter in 1283 and soon after became a commercial city and a member of the HANSEATIC LEAGUE. Pop. 1930, 40,473.



FROM JEPSON, MAN FL. PLANTS CALIF., COPYRIGHT

STAR ZYGADENE

Single flower and plant in bloom

ZYGADENE, a genus (*Zygadenus*) of handsome perennials of the lily family several of which are highly poisonous. There are about 12 species, native chiefly to North America. They are usually slender,

smooth, upright herbs rising from coated bulbs with narrow, mostly basal leaves, erect, greenish-white flowers borne in terminal clusters and deeply three-lobed capsules containing numerous seeds. Among the poisonous species are the death camas (*Z. venenosus*) of the Pacific coast, Nuttall's camas (*Z. Nuttallii*) of the Great Plains, and the grass-leaved camas (*Z. gramineum*) of the Rocky Mountain region. Other representative species are the sand-corn (*Z. paniculatus*) of the Pacific states; the star zygadene (*Z. Fremontii*) of southern California; the smooth zygadene (*Z. elegans*), found across the continent, and the pine-barren zygadene (*Z. leimanthoides*) of the south Atlantic coast. See also SOAP PLANTS.

ZYGOTE, a biological term applied to the product of the fusion of the reproductive elements in biparental (amphigonic) reproduction. In the lowest forms of life (*Protista*), the zygote not infrequently divides into a large number of spores each of which becomes a new individual.

In higher animals and man the zygote is the fertilized egg cell which immediately develops as a new individual. It is in fact a new individual in its earliest stage. While the term zygote is of general application, among plants the terms zygospore (lower plants) and oospore (higher plants) find frequent use. See also CELL; CYTOLOGY; EMBRYOLOGY; FERTILIZATION; REPRODUCTION; SEX; SPORE. B. F. K.

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